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Proposed Issuance of a New Source National Pollutant Discharge Elimination System Permit to Estech General Chemicals Corporation, Duette Mine Manatee County, Florida

Conservation Consultants, Inc, Palmetto, FL

Prepared for

Environmental Protection Agency, Atlanta, GA

Oct 79

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Region 4
345 Courtland Street, NE
Atlanta, GA 30308

EPA 904/9-79-044
October 1979

EPA Environmental Impact Statement

DRAFT

Estech General Chemicals Corporation
Duette Mine
Manatee County, Florida

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The Draft Environmental Impact Statement for the Estech General Chemicals (formerly Swift Agricultural Chemical) Duette Mine is enclosed for your review and comment. This document has been prepared pursuant to Section 102(2)(c) of the National Environmental Policy Act (NEPA) (Public Law 91-190) and applicable EPA regulations at 40 CFR Part 6.9. Thirteen volumes of resource documents were also prepared. These resource documents comprise the detailed technical evaluations of the alternatives and the proposed action and contain supporting data related to the Draft EIS. While the Draft EIS is a complete document.

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DRAFT
ENVIRONMENTAL IMPACT STATEMENT

for

Proposed Issuance of a New Source National
Pollutant Discharge Elimination System Permit

to

Estech General Chemicals Corporation
Duette Mine
Manatee County, Florida

prepared for

U.S. Environmental Protection Agency
Region IV, Atlanta, Georgia 30308
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Estech General Chemicals Corporation has proposed an open pit phosphate mine, beneficiation plant and rock dryer on a 10,394 acre site in northeastern Manatee County, Florida.
Mining will involve 6600 acres most of which will be reclaimed, and will produce 3 million tons per year for 21 years. The EIS examines alternatives, impacts and mitigative measures related to surface water, groundwater, air, wetlands, and other natural and cultural systems.

Comments will be received until November 30, 1979

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Regional Administrator

October 1979
Date

Summary Sheet For Environmental
Impact Statement
Duette Phosphate Mine
Estech General Chemicals Company

(X) Draft
( ) Final

U. S. Environmental Protection Agency, Region IV
345 Courtland Street NE
Atlanta, Georgia 30308

1. Type of Action : Administrative (X) Legislative ( )

2. Description of Action

Estech General Chemicals Corporation is proposing to construct and operate a phosphate mine beneficiation plant, and rock drying facility in northeastern Manatee County, Florida. The EPA Region IV Administrator has declared the proposed facilities to be a new source as defined in Section 306 of the Federal Clean Water Act.

In compliance with its responsibility under the National Environmental Policy Act (NEPA) of 1969, EPA Region IV has determined that the issuance of a new source National Pollutant Discharge Elimination System (NPDES) permit to the proposed mining and beneficiation facility would constitute a major Federal action significantly affecting the quality of the human environment. Therefore, this Environmental Imapct Statement was prepared in accordance with the requirements of NEPA and EPA regulations at 40 CFR, Part 6.

The proposed facility, the Duette Mine, encompasses 10,394 acres of which approximately 6,600 acres are deemed mineable according to present economic, environmental and technological limitations. The mining operation is planned to nominally produce 3 million tons of phosphate ore annually for a period of 21 years. Estech presently operates the Watson and Silver City Mines in southwestern Polk County, Florida. The Duette Mine will serve as a replacement for these facilities as their production expires.

Components of the proposed facilities include two draglines with 50 cubic yard buckets; hydraulic ore transportation via pipelines to a central washer for ore disaggregation and pebble recovery; a feed preparation and flotation plant for extraction of finer phosphates; a drying facility to reduce moisture in the phosphate rock from 13% to 2%; and shipment via rail.

Operation of the proposed facilities requires a mining plan, a water management system, and an integrated waste disposal reclamation plan.

The mining plan as proposed by Estech calls for the preservation of the majority of the sensitive or unique natural vegetation. The preservation areas include the sole cypress stand on the site (18 acres), a 50 acre stand of sand pine scrub, and the wooded floodplains of the major streams, with the exception of a three-quarter mile segment of the East Fork Manatee River. To protect wetlands along streams, the mine plan incorporates active mining along only one side of a wetland at a time.

The proposed disposal plan will utilize a sand-clay mix in the approximate ratio of 2.5 to 1 (by weight). A single 480 acre conventional clay settling area is proposed to receive any clay wastes in excess of the sand-clay mix requirements and to serve as a supplemental water clarification and storage area. Sand tailings in excess of the amounts required in the sand-clay mix process will be deposited in mining cuts.

The proposed water management plan divides the needed supply between surface and ground-water resources, minimizes mining process consumption, and provides for recharge of the Floridan Aquifer. The Consumptive Use Permit issued by the Southwest Florida Water Management District allows ground-water withdrawal at a rate of 13 mgd for the first 3 years. During this time, a 200 acre surface water reservoir will be constructed to provide storage for 3 mgd, thereby decreasing ground-water use to 10 mgd. Prior to withdrawal, a recharge system will be constructed to transmit water from the surficial aquifer into the deep system.

The proposed reclamation plan will be accomplished by the physical restructuring and refilling of disturbed sites followed by revegetation. The proposed methodology is designed to return the site to land forms compatible with its rural, agricultural setting. The reclaimed site will consist of improved pasture, marsh and wetland environments, five lakes, and a 100 acre "wilderness" area allowed to revegetate naturally. The proposed plan aims to provide long range water quality and biological diversity as well as aesthetic values in land form diversity, wildlife protection, recreational uses, and water resources.

3. Alternatives Considered

A. Beneficiation plant sites were evaluated to minimize loss of phosphate resource, water pumping, ore and waste transportation, road and utility construction, and destruction of environmentally sensitive areas. Six sites were considered.

B. Production rate alternatives were evaluated considering both environmental and economic parameters. Environmental aspects considered included rate of habitat alteration/destruction, rate of ground-water withdrawal, and level of air emissions. Economic considerations included production costs, overall rock demand and growth, and Estech's present production and marketing.

Alternatives were selected to evaluate the effects of various production rates rather than to designate an optimum production rate.

C. Resource recovery alternatives were evaluated with consideration given to impacts on environmental resources and recovery of mineral resources. The primary consideration was phosphate ore underlying forested swamps or marsh areas.

D. Mining methods were evaluated to assess ore recovery rates, energy use, water use and conservation, environmental resources, and safety. Alternatives examined were electric draglines, dredges, bucket wheel excavators, and technique combinations.

E. Ore transportation alternatives were evaluated considering the factors of technical and operational feasibility, cost, energy use, water conservation, and impact to the environment. Conventional slurry pumping, conveyors, and trucks were transportation methods considered.

F. Beneficiation process alternatives were evaluated for energy and water use efficiencies within proven state-of-the-art technology. Alternative processes considered were conventional beneficiation, total acidulation, and blast furnace.

G. Process water sources were evaluated to conserve the regional resource while providing a sufficient quality and quantity of water. Supply alternatives considered were use of surface and ground water, total requirement from the Floridan Aquifer, use of surface water in rainfall catchment, and use of water from the surficial aquifer.

H. Waste disposal and reclamation plans were evaluated for methods to dispose of sand and clay wastes in a manner that economically restores disturbed land to a productive state. Physical restoration and revegetation were considered in light of existing and planned environmental systems.

I. Surface water discharge alternatives were evaluated from two respects: volume of water discharges and point of discharge. Volume alternatives considered containment of long term accumulation, containment of short term accumulation, containment to offset evaporation losses only, and no containment. Eight points of discharge were evaluated. Each alternative was discussed in terms of environmental impacts, water use and economics.

J. Rock drying alternatives were evaluated to select an alternative which provided dry rock for shipping and met air quality standards. Alternatives assessed were construction of a dryer at the mine site, use of an existing dryer, construction of a dryer at a remote location, and shipment of wet rock.

K. Transportation and energy source alternatives were evaluated. Transportation alternatives included railroad with truck as emergency mode, trucks only, pipeline to port, and conveyor. Energy source alternatives assessed were commercially available electric power and various methods of on-site generation.

L. A no-action alternative was evaluated considering environmental and socioeconomic impacts of not constructing the mine, beneficiation plant, or rock drying facility.

4. Summary of Major Environmental Effects

Each of the selected alternatives was integrated into the appropriate land or water management strategy: the mining plan, waste disposal/reclamation plan, and water management plan, collectively the proposed activity. Environmental impacts of the proposed activity were then assessed. The major emphasis of the impact assessment was to identify means of minimizing the degree and extent of negative impacts caused by the mining operation at any one time and to minimize the permanent alteration and/or destruction of natural systems and environmental resources.

The direct effect of mining will be the physical destruction of much of the present natural vegetation and the alteration of the site's soils and topography. The proposed reclamation plan is intended to mitigate the long-term negative impacts of the minig operation. Major impacts to three major systems are as follows:

Land - Overall, 85% of the native upland vegetation will be lost. Reclamation is designed to replace most natural land communities with improved pasture, thereby largely precluding the re-establishment of original vegetation. A 50 acre stand of sand pine scrub is marked for preservation.

Land-Water Interface - Mining will destroy at least 476 acres of fresh water swamps and 364 acres of fresh water marshes. Proposed reclamation will restore these acreages and contribute additional acres for a net gain of 15% in land-water interface. The sole cypress stand (18 acres) on the site will be preserved.

Water - The direct impact of mining will be the destruction of 417 acres of ephimeral feeder streams and their floodplains. The remaining aquatic areas will suffer stress resulting from changes in temperature, sunlight, erosion, water table drawdown, and addition of various chemicals. The wooded floodplains of the major streams are excluded from mining, with the exception of a three quarter mile segment of the East Fork Manatee River which is proposed for mining and subsequent reclamation as a swamp.

Mining will create several lakes on the site, which is a significant expansion of the aquatic environment.

The proposed activity will significantly alter the site's original topography through strip mining and waste clay disposal activities. The long-term, net effects on topography are directly reflected in the proposed reclamation, which largely returns the site to pre-mining elevation and relief. On-going reclamation will limit the number of acres disturbed at any given time to about 700-800 acres.

Proposed mining will disturb the existing soils on approximately 75% of the site. Existing soil profiles will be destroyed and in general the surface horizon will be buried. Waste disposal and physical reclamation will result in three new types of surface soils: clay, sand-clay, and overburden. Each of the new reclaimed soil types has distinct agricultural and engineering properties that relate to post-reclamation land use potential.

The average annual ground-water withdrawals will be limited to 13 mgd less recharge of 3 mgd for a total net consumption use of 10 mgd. During the fourth year of mining, approximately 2.88 mgd of water will be diverted from the East Fork of the Manatee River to a surface water storage reservoir.

The primary effect of withdrawals from the deep ground-water system is the lowering of the potentiometric surface within the area of influence of the wells. This effect will be extremely small in comparison to the large seasonal fluctuation. Potential impacts to water quality in the deep aquifer system may be caused by the dewatering/recharge projects which directly transmit water from the shallow system to the deep aquifer system. Monitoring of the quality of water being discharged is required by the Southwest Florida Water Management District.

The primary effect of the mining on the shallow ground-water system will be the lowering of the water level within the system by the dewatering and/or recharge wells.

The proposed reclamation project may cause changes in water quality in the surficial aquifer as well as changes in on-site flow patterns within the surficial aquifer.

During active mining, stream flow into Lake Manatee will decrease by approximately 9%. After reclamation the average flows of the East and North Forks of the Manatee River will be reduced approximately 0.7 mgd and 0.6 mgd respectively. This decrease will be the result of increased impoundments in lakes and marshes and the sand/clay mix land fills. The major drainage courses on the mine site will be left undisturbed, except for a small segment of the East Fork Manatee River.

Discharges to streams leaving the proposed mine site from the plant water system may be necessary due to temporal variation in rainfall. It is anticipated that approximately 1.9 mgd will be discharged into the East Fork of the Manatee River during August and September of an average rainfall year; effluent will be discharged at a rate of 1.8 mgd into the North Fork during August, September, and October.

The proposed mining may be expected to contribute both primary and secondary air quality effects. Primary effects will be contributed by the operation of two phosphate rock dryers, storage, materials handling, and shipping facilities, as well as fugitive dust from land clearing and reclamation activities. Secondary effects will be contributed by population, commercial, and industrial development induced by the proposed project. Primary emissions from the rock dryers and associated facilities are very fine clay and phosphate rock particulates and by-products of the combustion of fuel oil, e.g., sulfur dioxide and ash. The proposed sources will not violate air quality standards nor significantly degrade air quality. SO_2 and particulate matter emissions will satisfy New Source Performance Standards and BACT.

There are no significant noises associated with mine-related activities that could be considered intrusive or detrimental to sensitive receptors because of spectral content or intermittency.

A potential direct impact of mining and beneficiation is that of occupational radiation exposure. The primary exposure areas are the rock pile transfer tunnels. The Duette operation, having both a plant design including properly ventilated tunnels and a lower product radioactivity level than the general mining region, should not exhibit adverse occupational exposure. The proposed fugitive dust control on dryer emissions should also limit off-site transport of airborne radioactivity to the point where annual dose cannot be measured within the statistical variation of natural background.

Upon completion of mining, reclaimed lands will have different radiological characteristics than the land before mining. Considering future agricultural uses of the site, the most important pathway is the direct uptake of radium-226 by row crops grown on the reclaimed clay settling area. Although the radium content is highest here, the land will be agriculturally suited for row crops. Study results suggest that the excess availability of the major cations produce a discrimination against uptake of Ra++ in the clay soils containing higher than normal radium-226. Regarding future residential development of the site, predicted indoor radon progeny levels indicate only the reclaimed settling area may produce levels requiring remedial action. The predicted clay land form indoor radon progeny level is 0.023 WL (working level). If the clay settling areas are excluded for structural reasons or topsoil replacement occurs, no reclaimed lands are predicted to produce homes with radon progeny levels near the 0.02 WL remedial action level.

Surface water radium-226 concentrations in off-site environs may be elevated from natural levels of 0.8 pCi/l to 2 pCi/l. The drinking water standard for radium-226 is 5 pCi/l. The ground water radium-226 concentrations at the site are between 0.8 and 6 pCi/l and are less than those observed in non-mining regions. Radium-226 levels in ground water appears to be associated with local subsurface conditions which are below the zone of surface mining influence.

The socioeconomic impact of proposed mining will exhibit a generally beneficial effect. Operation of the mine will directly require 324 workers, many of which will be relocated employees of the applicant. Some workers will be obtained from the Manatee County labor force. The direct economic effects of the mine are favorable, producing approximate annual yields of $382,400 in sales tax, $1.92 million in severance tax and $1.982 million in Ad Valorem tax. Regional economy effects derived through standard multipliers indicate an annual indirect impact of $35.4 million and an annual induced impact of $118.4 million. Estimated employment associated with the activity is similarly projected to be 235 through indirect impact and 1425 through induced impact. The mine will exert no directly discernable effects on community services and facilities as the operation will be self-sufficient in terms of minor medical treatment, water supply, fire and police protection, solid waste disposal and internal transportation facilities. The mine will not measureably increase demand on regional facilities for education, major medical treatment, recreation and transportation.

Long-term land use patterns will not be adversely impacted by the mining activity. The site is proposed for agricultural uses in the Manatee County Comprehensive Plan. The planned mine reclamation program is designed to return the site to land forms amenable to a variety of agricultural uses. On the short-term, the proposed mine site is located between two approved phosphate mines and therefore should not disrupt near-future land use trends in the area.

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1.0 INTRODUCTION

1.1 IDENTIFICATION OF THE APPLICANT

Effective August 1, 1979, Swift Agricultural Chemicals Corporation changed its name to Estech General Chemicals Corporation. The preparation of the Draft Environmental Impact Statement was substantially completed at the time of the name change. Therefore, the name of Swift Agricultural Chemicals Corporation (Swift) is used throughout this Summary Document and all attendant Resource Documents.

Swift is a wholly owned subsidiary of Estech Incorporated and has been a leading producer of agricultural chemicals since 1908. Swift presently operates the Watson and Silver City Mines in Southwestern Polk County, Florida. The Duette Mine phosphate reserve will serve as a replacement for these facilities as their production expires.

1.2 OBJECTIVES

Swift proposed a phosphate mining and beneficiation facility, at the Duette Mine in Northeastern Manatee County, Florida (Figure 1.1-1). The operation encompasses 10,394 acres, of which 6,600 acres are deemed minable. The operation is planned to produce three million tons of ore annually for 21 years. Construction of the facility is scheduled for 1980 with mining beginning two years later.

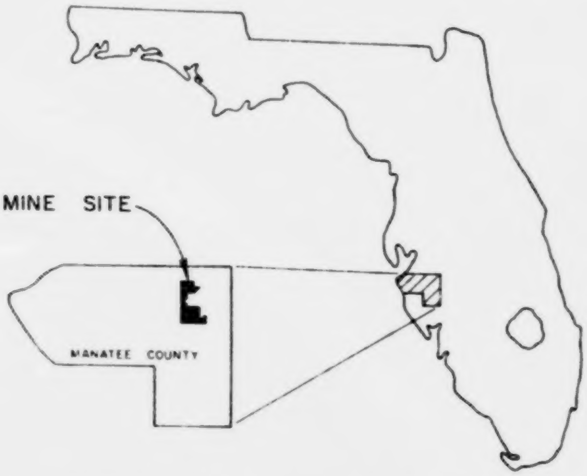


Figure 1.1-1 Location of Duette Mine

The water management plan divides the needed supply between surface and ground-water resources, minimizes process consumption, and provides for recharge of the Floridan Aquifer. Discharges of water will be minimized and monitored for compliance with regulatory requirements. Monitoring will also include air quality, earthen dam surveillance, and ground-water

The reclamation plan is primarily intended to return the site to agricultural uses. The plan proposes preservation of certain important wetland and upland plant communities and reclamation to wetlands. Wetland preservation and reclamation areas were incorporated to provide long-range water quality and biologic diversity as well as land form diversity, wildlife protection, recreational uses and water resources.

1.3 PROJECT HISTORY

Swift conducted prospecting in 1964 and 1965 to identify areas of recoverable phosphate rock. As a result, the 10,394 acre tract was purchased in 1965 - 1966. During 1975 and 1977, a study program of surface water and ground-water quantity and quality was conducted. Concurrently, baseline studies necessary for the preparation of an Application for Development Approval (ADA) were initiated. The ADA is part of the overall DRI process in Florida and is required by any project defined as a Development of Regional Impact (DRI) in Sec. 380.06, Ch. 22F-2, FAC.

Dragline purchase commitments were made in 1975 followed by additional prospecting in 1975 and 1977 to confirm mining areas for planning purposes and to establish extractable tonnage.

In April 1978, the ADA was filed with Tampa Bay Regional Planning Council (the State designated Regional planning agency) and Manatee County Planning and Development Department (the designated local agency having jurisdiction) to secure proper zoning. In addition, a Master Mining Plan, as required by Section III Manatee County Mining Ordinance, was submitted to the local agency.

In May 1978, the Duette Mine was designated by EPA a new source as defined in Sec. 306 of the Federal Water Pollution Control Act Amendments of 1972. Pursuant to this determination, the procedures specified in the National Environmental Policy Act were initiated which includes the preparation of an environmental impact statement as an integral part of th National Pollutant Discharge Elimination System (NPDES) permit application.

In September 1978, a Consumptive Use Permit (CUP) was issued by the Southwest Florida Water Management District (SWFWMD) pursuant to the requirements of Ch. 373, FS. and Ch. 16J-2, FAC. This state permit explicitly regulates the consumptive use of surface and ground water.

Other Local, State, and Federal permit applications are in various phases of development and are expected to be completed by October 1979.

2.0 ALTERNATIVES EVALUATION

The alternative assessments include: plant site location, production rate, resource recovery, processes for mining and beneficiation, water supply, waste disposal and reclamation techniques, discharge into surface water, rock drying, product transportation to port, power sources, and no-action. Objectives to be met in selection of the optimum alternatives are identified.

2.1 PLANT SITE ALTERNATIVES

It is the objective of a beneficiation site to be placed at a location that minimizes: 1) loss of phosphate resource; 2) water pumping cost; 3) ore and waste transportation cost; 4) road and utility construction cost; and 5) destruction of environmentally sensitive areas. Alternative sites are shown on Figure 2.1-1.

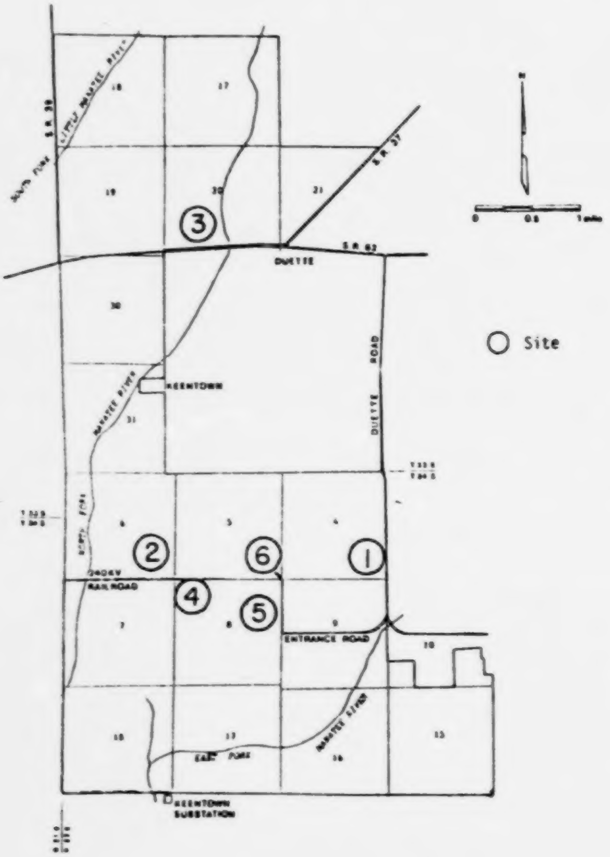


Figure 2.1-1 Alternative Plant Site Locations

Resource losses associated with alternative sites are: Site 1 - 511,500 tons; Site 2 - 0 tons; Site 3 - 2.325 million tons; Site 4 - 1.6 million tons; Site 5 - 1.6 million tons; Site 6 - 0 tons. The lowest net energy costs result from locating the plant site at the center of the ore body (Site 4) as shown in Table 2.1-A. The cost of material transportation is the most significant cost consideration. Energy consumption represents about 60% of this cost. In comparison, water pumping costs are small. Offsetting the savings in sites 4 and 5 is the resource loss. Locating the plant site nearer to existing access roads reduces development costs, but results in higher material transportation costs. Site 6 is considered as nil cost effect.

Table 2.1-A Economic Comparison of Site Alternatives

	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6
Reserve Loss (Short Ton Product $000's)	511.5	0	2,325	1,600	1,600	0
Cost Water Pump ($/ton Product)	+.006	+.007	0	+.0015	-.006	0
A. Energy Cost	+.005	+.006	0	+.0012	-.005	0
Matrix and Waste Pumpage ($/ton Product)	+.50	-.14	+1.99	-.47	-.19	0
A. Energy Cost	+.45	-.12	+1.80	-.39	-.17	0
Total Energy Cost ($/ton Product)	+.461	-.107	+1.80	-.383	-.181	---
Access Road, Railroad, Utility Cost ($000's)	+250	-80	+900	0	-22	0

Sites 4 and 5 have essentially the same environmental ramifications as the proposed location (site 6). Site 3 exhibits the greatest potential for disturbance of wooded floodplains preserved as a wildlife corridor and for damaging aquatic habitat due to minor spills and surface water withdrawal. This site also necessitates destruction of the environmentally sensitive, 18 acre cypress dome. It may also result in unacceptable noise levels at sensitive receptor sites. Site 2 exhibits some potential for wooded floodplain disturbance but does not otherwise differ significantly from the Swift proposal. The primary constraint on Site 1 is the potential for unacceptable air pollutant levels at the property boundary.

From the energy and cost point of view, the two most feasible alternatives are the Swift proposal (site 6), which would minimize ore transportation costs, and the western boundary location (site 2), which would have smaller material transportation and development costs than site 6. Site 2 does, however, exhibit a somewhat greater potential for damage to environmentally sensitive areas (floodplains) than site 6.

2.2 PRODUCTION RATE ALTERNATIVES

It is the objective of a production rate to produce rock that will make the corresponding cost of production competitive in the world market; to insure a reasonable profit; to maintain a production rate that will respond to overall rock demand growth; to replace present production as existing Swift facilities mine out; and to meet environmental permitting requirements.

The alternatives selected to illustrate various production rate effects rather than to definitely designate the optimum are production rates of 1.5 million tons per year, 3.0 million tons per year and 4.5 million tons per year.

Table 2.2-A summarizes the typical dragline requirements, capital costs, and production costs for the three production rate alternatives.

To meet Swift's overall objective, mining at a rate that will make the production costs competitive and will maintain their share of the market, it appears their proposed production rate has been reasonably selected.

Alternative one, at 1.5 million TPY, shows no growth increase and is a 10.7% reduction from present production. Alternative two, at 3.0 million TPY, replaces mined out production and provides for demand growth of the phosphate industry. Alternative three, at 4.5 million TPY, is excessive in that it is decidedly more than necessary to replace existing capacity and is in excess of historical growth rates.

Consideration of environmental aspects indicate all alternatives would have essentially the same long-term effects on vegetation and wildlife. Positive aspects of alternative one is that lower ground-water withdrawal rates would cause the least stress on regional water resources and annual particulate emissions would be lowest. Annual SO_2 emissions would be largely the same for alternative one and two but the long-term contributions of one would be twice that of alternative two. Alternative three has a considerable potential to exceed ground-water withdrawal limitations and exhibits the highest air pollutant contributions.

Table 2.2-A Production Rate Alternatives

Production TPY	---Draglines---			*Capital Cost Mine and Mill M $	*Production Cost Mine and Mill M $
	No.	Yards	M $		
1,500,000	1	50	13.0	53.55	20.875
3,000,000	2	50	26.0	90.00	18.284
4,500,000	3	50	39.0	119.54	18.000

*"Evaluation of the Phosphate Deposits of Florida Using the Minerals Availability System." Bureau of Mines. Open File Report No. 112-78. Zellars-Williams, Inc. June, 1978.

2.3 RESOURCE RECOVERY ALTERNATIVES

It is the objective to maximize recovery of the non-renewable mineral resources at an acceptable cost with consideration given to impact on renewable natural resources, principally wetlands.

Three cases of resource recovery are considered. Case 1, the proposed action, represents the mining and reclamation plan of Swift. Resource recovery of this plan would be about 61.5 million product tons of phosphate rock recovered over a 20-21 year mining period. In achievement of the proposed recovery, Swift has excluded the lower quality "unmineable" ore and ore of varying quality underlying much of the forested swamp community found along major water courses and the cypress dome. Case 1 includes mining approximately 360 of the 600 acres of freshwater marsh, 55 acres of the East Fork Manatee River, and most of the small feeder streams.

Case 2 excludes the mining of all freshwater swamp but includes mining of marshes as in Case 1. Resource recovery would be about 57.65 million product tons of phosphate recovered over a 19-20 year mining period. A presumption in this case is that, with the exception of a higher depreciation rate to account for the resource loss, higher extraction costs would not result.

Case 3 includes recovery of all phosphate rock resources regardless of vegetative cover or current land use. Resource recovery would be about 65.9 million product tons of phosphate recovered over a 21 1/2 - 22 1/2 year mining period. The case includes mining of approximately 950 acres of forested swamps (including most of swamp along major drainage courses and the cypress dome) and mining of marshes as in the previous cases.

Table 2.3-A shows the tradeoff relationship between resource recovery cost and regulatory constraints.

Table 2.3-A Resource Recovery Alternatives and Regulatory Constraints

Change in Resource Recovery	Change in Cost	Meets Regulatory Constraints
Case 1 - Proposed Action	-0-	Permit required for East Fork Manatee River System
Case 2 - Loss of of 3,850,000 tons	Would create slightly higher depreciation rate to account for the resource loss.	Would meet maximum constraints regarding wetland protection
Case 3 - Add 4,400,000 tons rock	Any mitigative action would add to costs.	Would require approval of DER and Corps of Engineers

Case 1, as proposed by Swift, is presented as nil cost. Case 2 has a nil cost effect but would lead to loss of 3.85 million tons of phosphate resources. Case 3 increases resource recovery, but has the unknown but assumably significant cost effect of adding extensive mitigative action (wetlands restoration).

With regard to the tradeoff relationship between resource recovery and potential adverse impacts on marsh-type systems, it appears negative effects would, at worst, be of low magnitude and significance considering both biologic and hydrologic functions. For all cases, freshwater marsh re-establishment through reclamation is expected to be a relatively rapid process even when un-assisted. Although the potential exists for development of pure stands of cattails in constructed depressions and lake littoral zones, this occurance would not be expected to significantly affect the hydrologic function of the re-established marshes. The cattail marshes would also be expected to support many of the animals inhabiting pre-mining marshes of the site.

Concerning the balance between resource recovery tradeoffs and potential impacts related to mining of freshwater swamps, each alternative offers distinctly different implications. Case 2 represents the "least risk" alternative as all wooded wetlands, regardless of importance, would be maintained intact. This would incur the irretrievable loss of several million tons of phosphate rock product over the other alternatives. Case 3, on the other extreme, offers maximum resource recovery but with the potential of incurring highly significant, high magnitude adverse effects on all important biologic and hydrologic systems if freshwater swamp regrowth is unsuccessful. Case 1, not necessarily intermediate to the extremes, also offers the possibility of moderately significant, high magnitude adverse effects if freshwater swamp regrowth is unsuccessful in the mined, one-mile segment of the East Fork Manatee River.

Based on the operation cost/resource recovery and potential impact/resource recovery comparisons made, the current optimal alternative would appear to be somewhere between Case 1 -Proposed Action and Case 2 - Swamp Exclusion as large scale wooded wetland restoration efforts are unproven. Case 2 includes preservation of some wooded wetlands that are isolated and/or normally intermittent in nature and exhibit insignificant or minor hydrologic and biologic functions. Conversely, Case 1 proposes mining of largely undisturbed, heavily wooded floodplains that contribute significantly to the overall hydrologic and biologic functioning of site and general area.

2.4 MINING METHOD ALTERNATIVES

Mining method objectives are maximum recovery of the mineral resource at optimum cost with reasonable use of energy, water, and environmental resources. Mining is to be conducted to allow for efficient and useful land reclamation.

Only open pit (strip mining) ore extraction methods are considered feasible since underground mining is not suited for sandy soils prevalent in Manatee County. Mining method alternatives, therefore, include large electric walking draglines (proposed case), dredges, bucket wheel excavators (BWE) and technique combinations.

Table 2.4-A summarizes the factors evaluated in the mining methodology assessments.

Table 2.4-A Comparison of Mining Alternatives

Item/Case	Dragline	Dredges	Wheels	Combination
Ore Recovery	85-87%	80-82%	88%+	88%+
Cost, $/Ton, Prod.	1.30	1.38	1.99	1.38
Energy Use, KWH/Ton	12.6	25.0	21.7	22.9
Water	B	S	B	S
Environmental	E	E	E	E
Safety	S	S	P	P

Ratings: B-Best, S-Satisfactory, P-Poor, E-Equal

With regard to ratings shown in the table, the conventional dragline mining operation does not consume water directly. Dredge mining may result in a minor loss of water by formation of colloidal clays when dredging and pumping overburden. From a water conservation standpoint, draglines and bucket wheels are preferred. Open pits (draglines and BWE's) temporarily affect the adjacent water table by pit dewatering. Dredges would have less impact if pools are maintained at a high level.

With regard to safety, "in the pit" operations can be hazardous due to highwall failures. Thus, the bucket wheel technique is considered to be less safe than other methods. Dredge operation requires people to work over water, which can be hazardous. Failure of highwalls is also possible in dragline operations.

All open pit extraction alternatives would exhibit largely the same long-term impacts on vegetation and wildlife assuming like areas are mined and are similarly reclaimed. The dredge method would not, however, necessitate dewatering of the mine pit and the attendant lowering of the water table on either side of an active pit.

Based on the tabular comparison, the dragline would be preferred although dredging would be acceptable.

2.5 ORE TRANSPORTATION ALTERNATIVES

Transporting the matrix from the mine to the beneficiation plant should be achieved at a minimum cost with optimum use of resources and with minimal effect on the environment. The alternatives which merit consideration include conventional slurry pumping (proposed action), conveyors, and trucks.

The factors considered in the assessment of ore transportation alternatives include technical and operational feasibility, cost, energy use, water use/conservation, and environment. Table 2.5-A compares the factors considered in the ore transportation alternatives.

Table 2.5-A Comparison of Ore Transportation Alternatives

Item/Case	Pumping	Conveying	Trucking
Cost $/ton, Product	$ 0.92	$ 0.88	$ 1.33
Energy Use, KWH/Ton	17.3	11.2	N/A
Water	E	E	E
Environment	S	B	P
Operational	S	U/P	P

Rates: B-Best. S-Satisfactory, P-Poor, E-Equal
U/P-Unproven in phosphate. Energy use (KWH) for trucking is included in the Cost $/ton.

The slurry method is currently used by companies operating in the Central Florida field and has proven technical and operational feasibility.

In the conveyor method, uniform feeding of matrix to the belt would be a significant problem. Draglines could not place 50 tons of matrix directly in a belt feed hopper. It would be necessary to provide an intermediate receiving and belt feeding system. It is also necessary to disaggregate the belt-conveyed matrix with high pressure water and hammer mills once it arrives at the washer.

Truck transportation of ore is practical in many mining operations and very large trucks have been developed for this purpose. Operational problems associated with truck transport, however, would include secondary handling of the matrix (small bucket wheel or payloader) as they cannot be loaded directly with a 50 cubic yard dragline, disaggregation of ore at the washer and labor intensity of truck driving and maintenance. Road construction would also cause problems for trucks (e.g. river crossings, highway crossings, poor soil conditions, heavy seasonal rainfall).

The use of water as a medium of transport in pumping does not consume water. The alternative ore transportation systems are similar in effect on water use since, in each case, the ore is disaggregated.

Concerning the environmental ratings, pumping and conveying alternatives would each eliminate about 15-20 acres of wetland vegetation due to construction of stream crossings. It is assumed the construction of truck crossings would eliminate some greater amount due to the need for heavy duty bridges on pilings or culverts with approach fill.

The pumping and conveyor alternatives each offer a potential for spillage of transported materials at stream crossings. Extensive spills of truck transported materials into streams is considered remote. The greatest potential for adverse effects related downstream sedimentation by spill materials would appear to be associated with pipe-wall rupture in the pumping alternative if secondary protective measures fail.

The only alternative with significant implications for addition to air pollutant burdens is the truck transportation alternative.

Due to lower energy costs, transport of ore by conveyor is the most economical alternative; however, the operational viability of this method is unproven. The problem associated with transferring the ore from the dragline to the conveyor and the need to relocate the conveyor continuously as mining advances are significant disadvantages of the conveyor transport method. The continuing increase in power cost makes further study of this alternative prudent. However, in view of the proven reliability of pumping and its compatability with the dragline and dredge mining alternatives, the ore pumping alternative is currently the most satisfactory ore transport method.

2.6 BENEFICIATION PROCESS ALTERNATIVES

The purpose of beneficiation is to reject the maximum amount of contaminants while recovering the maximum amount of phosphate from the ore. These objectives are to be achieved at optimum cost considering the end use of the rock product. The processes employed are to be energy and water use efficient.

The alternatives to conventional beneficiation do not offer any effective solutions. The total acidulation process (direct acid conversion of matrix) is only experimental and not available for use at this time. Furnace alternatives (high temperature decomposition) are cost and energy intensive and unsatisfactory for this ore body. Thus, conventional beneficiation is considered optimum.

2.7 PROCESS WATER SOURCE ALTERNATIVES

The process water supply objective is to provide water to the mining operation of sufficient quality and quantity to optimize operational and mineral recovery efficiency while conserving the regional water resource.

Supply alternatives considered are: use of surface and ground water (proposed action), total requirement from the deep Floridan Aquifer, use of surface water in rainfall catchment and use of water from the surficial (water table) aquifer.

Table 2.7-A compares the quality, dependability, energy cost, and resource impact of the water supply alternatives. The ground-water resource, whether from the shallow or deep aquifer, is presumed to be of highest quality. The availability of water from the deep aquifer is assumed the most dependable.

Swift's base case (Alternative 1) uses both ground-water and surface water. This alternative provides for a dependable source of sufficient high quality water for the beneficiation process and reduces the impact on the deep aquifer compared to the exclusive use of ground-water (Alternative 2). Pumping costs are also less for this alternative relative to ground-water pumping alone.

Alternative 2 (Floridan Aquifer) impacts only the ground-water resource in the deep aquifer. This alternative provides for a dependable source of high quality water. Pumping costs are slightly higher than for Alternative 1. The impacts of ground-water pumping are acceptable for the first three years, but for the long term, Alternative 1 is preferred because of its reduced impact on the deep aquifer.

Alternative 3 (rainfall catchment) has the lowest pumping costs but is not acceptable in terms of water quality or dependability. In addition, this alternative has the potential of reducing the downstream surface water supply, would destroy hardwood floodplains by reservoir construction, and has not been proven technically feasible.

Alternative 4 (surficial aquifer) has the highest pumping costs and would not provide a dependable source of water. In addition, this alternative would have an adverse impact on the maintained vegetation on site because of drought conditions imposed on the surface soils for the 20-year mining period.

In view of these considerations, the base case as proposed by Swift (Alternative 1) is the optimum blend of various resource uses and power cost considerations. The mitigative action of implementing recharge wells makes this alternative even more attractive.

Table 2.7-A Comparison of Alternatives for Water Supply

Alt.	Quality*	Dependability	Resource Impact	Pumping Cost
Alt. #1	Excellent G/W Poor S/W	Dependable	G/W and S/W	$72,000
Alt. #2	Excellent	Dependable	G/W only	$80,000
Alt. #3	Poor	Not dependable	S/W vegetative system & downstream use	$47,000
Alt. #4	Excellent	Not Dependable	Vegetative impact	$161,000

*Quality is expressed in relative usefulness in the amine circuit of the flotation system.

2.8 WASTE DISPOSAL/RECLAMATION ALTERNATIVES

The objective of the waste disposal/reclamation plan is to dispose of the sand and clay wastes in such a way as to economically restore disturbed land to a productive state, considering both existing and created environmental systems.

The selection of waste disposal methods and sites is the first step in the alternative assessment process, followed by alternative means of physically restructuring the disturbed or mined areas, and finally a revegetation alternative selected to match the intended use of the reclaimed site. In actual practice, alternative selection proceeds concurrently at all three levels. Within each step, many variations (methods) are available. These variations are presented in detail in the Alternatives Evaluation Resource Document concerning Waste Disposal/Reclamation Alternatives. Considering all three levels of alternative selection - waste disposal, physical restoration, and revegetation, a set of the alternatives capable of meeting the applicant's goals can be established. Two cases have been selected for final comparison.

Case I - Case I may be described as the best case application of conventional waste disposal and reclamation techniques. Under this case, clay and sand wastes would be disposed of in separate areas. Except for the required initial clay settling area on natural ground, waste disposal would be confined to mined-out areas. This requires the construction of approximately 3,604 acres of conventional clay settling areas with dams averaging 50 feet in height, of which 480 acres would be on natural ground. The remaining 3,500 acres of mined-out land would be used for sand tailings disposal.

All clay settling areas would be reclaimed by the crust development technique so as to leave the clays in the surface soil. Sand tailings landfills would be capped with overburden to an approximate depth of two feet. It was assumed that reclamation of the approximately 255 acres required for the plant site and support facilities would be the same for both cases.

All reclaimed areas initially would be planted in forage species. As is frequently practiced, scattered tree plantings would be made in reclaimed pasture areas at a density of two trees per acre, of which half would be 2"-4" transplants and half would be potted seedlings. Since wetland restoration is not currently part of conventional reclamation technology, it was assumed that no areas would be restored as wetlands. Also, no areas would be allowed with minimal reclamation to revegetate naturally since this is at variance with current local and state reclamation standards.

Case II - Case II is the Swift plan. Under this plan, the sand/clay mix technique is the primary waste disposal method, requiring a total of 5,426 acres, of which all but 200 acres are in mined-out areas. An initial 480-acre conventional clay settling area with a dam height of 30 feet is required on unmined land. Approximately 848 acres of conventional sand tailings disposal areas in mined-out pits are also elected. The remaining 574 acres of mined-out land is not utilized for waste disposal.

All sand/clay landfills are reclaimed without the use of capping material. The single clay settling area is reclaimed by the crust development technique and sand tailings disposal areas are capped with approximately two feet of overburden. The acreage not required for waste disposal is reclaimed as land and lake areas. Of this 574 acres, shallow zones amenable to marsh establishment would be created on approximately 90 acres along the margins of four reclaimed lakes and a 100-acre area would be physically altered only by the partial leveling of spoils to provide an area amendable to natural revegetation. The 255 acres required by the plant site and support facilities will be physically reclaimed by conventional means of dismantling facilities, grading to approved slopes, etc.

Revegetation plans for Case II include the planting of 5,928 acres of improved pasture with a mixture of grass and legume species. Mixed forest strips totalling approximately 58 acres would be planted in upland reclaimed pasture areas. Approximately 485 acres of forested wetlands would be planted, primarily along major drainage swales and also along a restored segment of the East Fork Manatee River. Approximately 538 acres of shallow aquatic environments created in sand/clay landfills would be allowed to revegetate naturally. Along with the 90 acres of shallow zones created in the margins of reclaimed lakes, this constitutes a total planned marsh restoration of 628 acres. The 100-acre land and lake area subjected to only partial spoil grading would be allowed to revegetate naturally. All the land areas associated with the remaining 384 acres of land and lake areas would be grassed.

The two cases must be judged on the basis of their relative costs and on their ability to achieve the applicant's economic and environmental objectives for the reclaimed site. Ideally, the lowest cost method will produce the most favorable results.

In lieu of such ideal conditions, the economic and environmental productivity of the reclaimed site should justify the added cost incurred.

Developing precise figures for waste disposal/reclamation costs requires input data derived from detailed engineering studies. This is, of course, not possible when comparing two conceptual alternatives. A further complicating factor in this analysis is that there is very little actual field experience with the sand/clay mix technique upon which to base cost estimates. Nevertheless, it is possible to make approximate cost comparisons based on published methods of estimating mining and reclamation costs (Zellars-Williams, Inc., 1977b; Zellars-Williams, Inc., 1978). Table 2.8-A summarizes the cost comparison between the two described cases based on these methods of cost estimation.

Table 2.8-A Cost Comparison Between Alternative Cases

	Total	Cost/Ton Product	Total	Cost/Ton Product
	Case I		Case II	
Waste Disposal/Physical Restoration				
o Conventional Clay Settling Areas	$42,365,000	$0.689	$ 3,026,000	$0.049
o Sand Tailings Disposal Areas	$21,414,000	$0.348	$ 4,704,000	$0.077
o Sand-Clay Mix Areas	-	-	$68,504,000	$1.114
o Land and Lake Areas	-	-	$ 760,000	$0.012
o Plant Site and Support Facilities	$ 128,000	$0.002	$ 128,000	$0.002
Revegetation	$ 2,797,000	$0.046	$ 2,663,000	$0.043
Grand Total	$66,704,000	$1.085	$79,785,000	$1.297

According to this cost comparison, Swift's selected waste disposal/reclamation plan will cost $0.21 more per ton of product produced or approximately 20 percent more than conventional waste disposal/reclamation techniques.

In rating the two cases for achievement of long-term economic goals, Case II must be given the preference. The approximately 5,400 acres of sand/clay soils planned in this alternative are projected to be more productive than the soils which result from conventional waste disposal/reclamation techniques. Moreover, under Case II, disturbed land will be returned to a productive use at an earlier date than for the conventional waste disposal case.

The risk of a dam failure and its resulting environmental (and economic) damage is greater in Case I. Case II has the most obvious advantage over Case I in the area of revegetation efforts to mitigate the loss of natural communities to mining. In Case

I, all reclaimed areas would be improved pasture resulting in a permanent loss of 364 acres of marsh and 476 acres of swamp. As river swamps and marshes were found to be the most productive wildlife habitats of the site, the reduction would significantly reduce the long-term carrying capacity of the mine site. In Case II, a variety of revegetation efforts are proposed to attempt re-establishment of destroyed wetland habitat. The Case II planned restoration of over 1,100 acres of wetlands represents a significant contribution towards mitigating adverse impacts of mining on local wildlife populations. Additionally, reforestation strips (hedgerows) in upland areas and abandonment of a minimally reclaimed 100 acre area will provide areas of wildlife habitat not available in Case I.

The advantages Case II offers, in terms of both the economic and environmental productivity of the reclaimed site, appear to justify the added costs this alternative imposes over the more conventional Case I alternative. Case II, therefore, may be designated as the optimum alternative. Due to the conceptual basis of the plan, it is expected that modifications will be made (in practice) in response to more detailed engineering and to variables in actual operations.

2.9 SURFACE WATER DISCHARGE VOLUME ALTERNATIVES

The objective is to keep the amount of discharged water to a practical minimum, dictated by feasible economic limitations, while maintaining the quality of all discharged water at the applicable standards for the receiving water. Alternatives considered regarding discharges from the mining operations include: 1) Containment of long term accumulation (55 in. rainfall/yr.); 2) Containment of short term accumulation (50 in. rainfall/yr.); 3) Containment to offset evaporation losses only (Proposed Action) and 4) No containment.

Table 2.9-A summarizes the alternatives. The optimum alternative, based on the comparison, is number three. Alternative one is costly and it possesses the potential for dike failure. Alternative two is also substantially more costly than alternative three and possesses the potential for dike failure, as in alternative one. A financial or resource loss would also be incurred due to the construction of impoundments over areas containing mineable phosphate ore. The reduced potential for surface water degradation or water conservation is not deemed sufficient to offset the previously mentioned negative attributes. The selection of the third alternative, however, does not completely define it as the optimum possible system. Improvements or modifications possibly can be implemented by Swift, during design or operation, to further feasibly reduce discharge. Alternative four would require additional water to be obtained from either the rivers or deepwells.

Table 2.9-A Comparison of Discharge Volume Alternatives

	Estimated Initial Impoundment Costs	Potential Liability	Effect on Surface Water Quality	Remarks
Alt. 1	$4.3 million	Maximum	None	Loss of resources due to extra impoundment construction.
Alt. 2	$2.1 million	Similar to Alt. 1	Potential for increase in TDS and TSS in receiving stream.	Loss of resources due to extra impoundment construction.
Alt. 3	None	Minimum	Increased potential for increase in TDS and TSS in receiving stream.	Discharge must be acceptable quality
Alt. 4	None	Minimum	Increased potential for possible increase in TDS and TSS in receiving stream.	Discharge must be acceptable quality.

2.10 DISCHARGE POINT ALTERNATIVES

The objectives of discharge point selection are to maximize water conservation and management at the lowest cost while meeting water quality standards for the receiving waters. The alternatives assessed regarding their ability to achieve the stated objective include : 1) discharge directly into East and North Fork Manatee River; 2) discharge directly into North Fork and into pool connected to East Fork Manatee River; 3) discharge directly into North Fork, into river overflow pool when not full, and directly into East Fork when river overflow pool is full (Proposed Action); 4) discharge directly into East Fork Manatee River; 5) discharge into river overflow pool connected to the East Fork; 6) discharge directly into East Fork Manatee River when overflow pool is full; 7) discharge directly into North Fork Manatee River; and 8) deepwell injection of all discharge water.

Assuming they meet water quality standards, all alternatives appear acceptable with the exception of alternative eight. The optimum alternatives based on comparisons presented in Table 2.10-A would be alternative two or Swift's plan (alternative three). Both alternatives maximize water efficiency and minimize discharge although alternative two is more cost effective. The cost difference is, however, off-set by operational effectiveness of discharge flexibility inherent in alternative three. Alternative eight is rejected because of increased risk of contaminating ground water and the high capital cost associated with deepwell injection.

Table 2.10-A Comparison of Discharge Point Alternatives

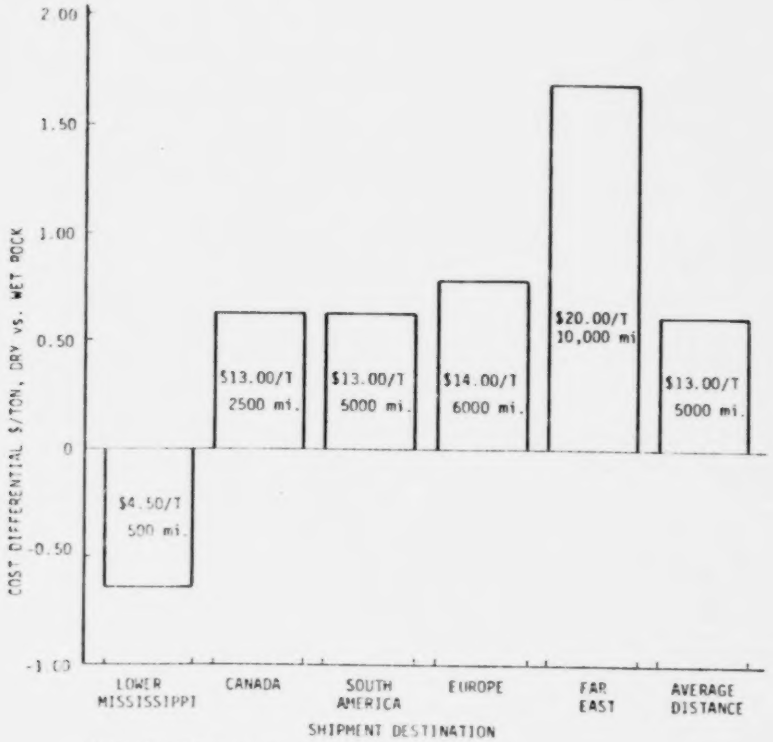
Alternatives	Estimated Capital Cost	Water Management Efficiency
1	$ 18,000	Fair
2	12,000	Good
3	19,000	Good
4	15,000	Poor
5	9,000	Fair
6	16,000	Fair
7	3,200	Poor
8	600,000	Fair

2.11 ROCK DRYING ALTERNATIVES

The objective is to prepare the phosphate rock for shipment in a condition acceptable to customers while meeting regulatory requirements regarding air pollution. The alternatives selected for assessment are: 1) Install rock dryer at the Duette Mine (Proposed Action); 2) Ship wet rock; 3) Use existing dryer at remote location; and 4) Install rock dryer at a remote location.

The proposed action of drying the rock at the mine is the least costly while meeting the objective of providing an acceptable product to the customer. The cost of transhipment, primarily the handling of the rock at a separate dryer site, adds more than $1.00 per ton to the cost of the product; therefore, contract drying at an existing site or construction of a new dryer at an alternate site are expensive alternatives. Drying at a port facility could be a viable alternative since the product would of necessity require some handling and possibly storage which would normally be a part of the mine's dryer facilities. These costs would then be transferred from mine to port site. Cost savings in fuel for drying are also a possibility at a port location. There are no existing public port facilities, however, that offer these advantages to Swift.

In terms of operating costs at the mine plant site, shipping wet rock is less expensive than drying the rock. These costs, however, are only transferred and increased if the customer is not capable of processing the wet rock since water must be shipped and then removed by drying. As shown in Figure 2.11-1, the heavier wet rock results in higher delivered costs at all points of delivery except the lower Mississippi. Beyond the 1,000 mile radius, shipping costs exceed drying costs; therefore, the competitive marketing cost becomes a major factor. Product grade, quality, and condition become more important in the world market and customer specifications will remain an important consideration.



Basis: $1.75/Ton to dry rock at the plant site.

Note: Ocean freight rates and mileages are for typical phosphate shipments from the port of Tampa.

Figure 2.11-1 C&F Port of Entry Cost Differential Dry vs Wet Rock.

Total acceptance of wet rock, as the basic form of the phosphate rock commodity on the world market, is not expected for some time. Many users have small phosphoric acid plants and the designs vary widely making conversion to wet rock not only expensive, but technically difficult. Conversion to wet rock also requires installation of wet rock grinding in addition to major wet phosphoric acid process design changes. Significantly, capital for the modifications is not readily available in many developing countries.

Some dry rock is used to produce triple superphosphate for which no wet rock process exists. If drying at the acid plant is desired, small dryers located at small plants are inefficient and very expensive compared to the large units employed by rock producers.

More energy in the form of fuel oil is consumed to dry the rock than is consumed to ship the additional water in the wet rock, assuming that the rock will not be dried at the final destination. Figure 2.11-2 shows how energy consumption to ship the moisture in the rock increases with shipping distance and how it compares with the energy consumption to dry the rock. In the case of rock dried at the final destination, energy consumption would be the greatest since the energy consumed in shipping the water would be added to the energy consumed in drying the rock.

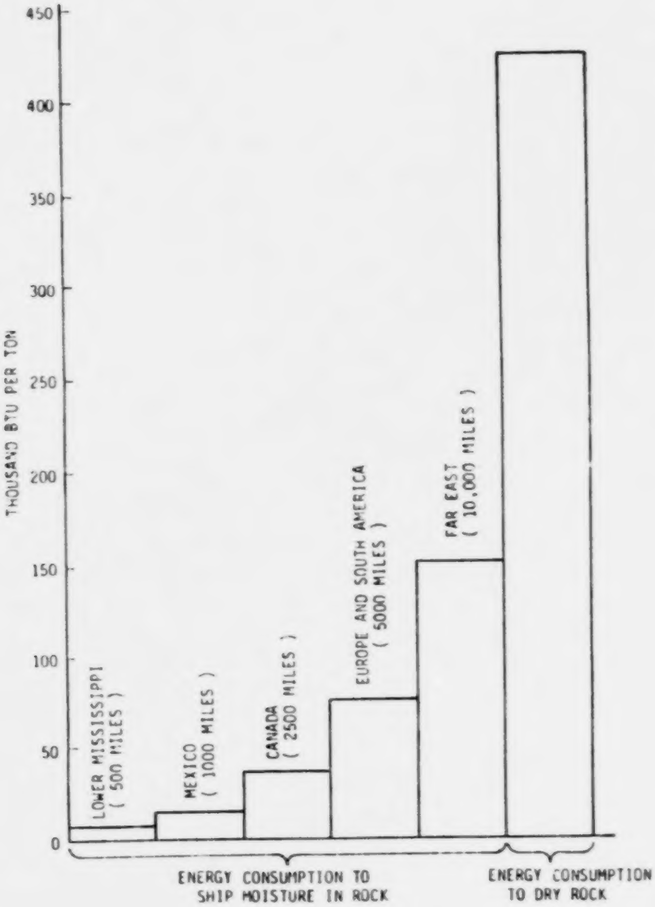


Figure 2.11-2 Energy Consumption

From an environmental viewpoint, a ranking of alternatives from best to worst may be characterized and summarized as follows:

o Ship Wet Rock - This is the best environmental choice only if the rock is not dried in less efficient and less effectively controlled equipment at the destination. From a standpoint of phosphate rock customer requirements, it is, in effect, also a no project alternative. Within the range of available and viable environmental alternatives, the present preemptive nature of this alternative suggests that it even be excluded.

With a gradual shift to wet rock grinding and processing facilities, wet rock shipping may eventually be demonstrated as reasonably practical and a preferred environmental alternate.

o New Dryer at Remote Site - It is assumed that the site would be within a developed port facility of the region. Also it is assumed that the air and water quality conditions at the remote site are sufficiently marginal with respect to standards that present source emission regulations could not produce the necessary conformance to ambient air quality standards and that the required additional level of emission control would reduce pollutant contribution to the regional pollutant burden and produce a better environmental choice. For example, the best site would be within an area designated for non attainment, because the new source would have to negotiate at least a corresponding reduction from another source so that there would be a projected reduction in area emissions. This extreme example should indicate potential economic unattractiveness added to economic disadvantages discussed above.

o Dryer at Duette Mine (Proposed Action) - It is required that this new facility be designed, constructed and operated in accordance with the existing body of environmental legislation and regulations designed to protect the public health and welfare. It must be recognized that the environmental analyses suggest these requirements can be satisfied, and in some cases, with considerable margin. Thus, the alternative is considered an environmentally acceptable action.

o Use Existing Dryer at Remote Location - Continued or expanded use of older, less effectively controlled equipment located in areas marginal with respect to air quality standards would increase regional pollutant burdens.

Both wet and dry phosphate rock are minor gamma radiation sources, and there is no measurable difference in radiation levels between the two products. Lung dosages of radiation are higher near rock dryers, but conventional dust control systems maintain radiation levels within the guidelines for occupational exposures. The application of best available control technology for new source dryers would reduce pollutant concentration levels even further. Workers near adequately ventilated wet and dry rock handling facilities, generally are not exposed to radiation levels exceeding the guidelines for the general population.

Pollutant Control System Selection: Prevention of Significant Deterioration (PSD) regulations include a requirement for application of Best Available Control Technology (BACT) to major source developments. BACT is a formalized analysis of potentially applicable control systems and a final selection based on performance (i.e., pollutant removal efficiency), economics (i.e., capital and operating costs) and irretrievable energy requirements. The process is completed following regulatory approval of the control concept and issuance of a BACT Determination.

A preliminary evaluation of pollution control systems narrowed the evaluation to two practical alternatives for both the dryer facilities and fugitive dust control systems---fabric filtration (baghouses) and wet scrubbing technologies. A review of the advantages and disadvantages of these systems lead to the selection of the proposed venturi-absorbers and wet centripetal vortex contact scrubbers.

2.12 PRODUCT TRANSPORTATION ALTERNATIVES

The transportation objective is to ship the phosphate rock to local or port destination as efficiently and safely as possible with minimum disruption. The alternatives selected for assessment are: 1) Railroad with truck as emergency mode (Proposed Action); 2) Trucks only; 3) Pipeline to port; and 4) Conveyor belt.

The presently feasible alternatives for transportation of the phosphate rock to the port facilities in the Tampa Bay area appear to be that of railroads and/or trucks. Both the pipeline and conveyor belt alternatives present the significant problems of obtaining a continuous zone of right-of-way and/or land purchase for a route to a port and prohibitive capital costs for construction. Railroads are established in Central Florida and they are reliable. The initial capital cost of installing the railroad to the mine from existing facilities would be weighed versus operational cost. Presently, rail is the most economical transportation available because it uses less energy and is generally environmentally acceptable. Long trains can disrupt traffic at various intersections with major arteries. The truck alternative will use more energy, but it is a lower capital investment and, in some cases, has a higher reliability. However, it has environmental (air pollution) considerations, it would contribute to traffic congestion, and it is not known if the present road systems have the ability or capacity to handle the traffic.

2.13 ENERGY SOURCE ALTERNATIVES

The objective is to maintain maximum efficiency in energy conservation while minimizing energy costs and environmental disruption.

Energy source alternatives assessed are: 1) Commercially available electric power (Proposed Action); 2) On-site coal, oil, gas powered generator; 3) On-site nuclear power generator; 4) On-site solar power generator; and 5) On-site hydroelectric generators.

The only feasible alternative is to purchase the required power from a commercial producer. This source is practically cost-free to the miner to build and maintain and is environmentally acceptable.

On-site generation by coal, oil, or gas would have four costly drawbacks or constraints; the capital cost; the cost of operating the plant (personnel and fuel cost); valuable mineral resources could be covered by the on-site energy plant; i.e., building and cooling pond area could not be mined for phosphate; and special measures would have to be taken to insure a nonpolluting energy system. Regarding nuclear generation, with the exception of a reduction in air pollution, this alternative has the same drawbacks as generation by coal, oil, or gas. In addition, strict control of the fuel and security for fuel waste disposal would have to be resolved at considerable expense to Swift. Current solar power technology has not advanced to the point where sufficient electrical energy could be obtained from the sun to satisfy mine requirements on a practical, non-interruptable economic basis. None of the streams on the property are capable of supplying the needed steady water flow to provide the mine's electrical requirements through hydroelectric generators.

2.14 NO-ACTION ALTERNATIVE

The no-action alternative would be to not construct the proposed New Source on the Duette tract and to allow the area to continue its present day socioeconomic and environmental trends. Summarized below are general local and regional effects related to continuance of the present day trends with reference made to the potential influence of the proposed Swift activity on these trends.

Socioeconomic - The general socioeconomic effects of the no-action alternative on the region and local area can be derived from baseline descriptions and projections of demography, economics, and community services. These baseline elements indicate that failure to construct and operate the proposed new source would exert little effect, positively or negatively, on general regional or local projections for population growth, economic growth, or demands for community services and facilities.

The region, and Manatee County specifically, has a considerable immigration of new residents and an expanding and diversifying employment base. These trends could be expected to largely mask any effects exhibited by the no-action alternative on regional or local demography or employment. The region and Manatee County would be expected to continue its general trend of population growth and employment diversification as a result of its favored "Sunbelt" location. With regard to community services and facilities, demands would be expected to increase, unaffected by the status of the Swift proposal. These demands would be created through general population growth pressures. In any case, phosphate mines are generally isolated and, by necessity, are largely self-sufficient in fire and police protection, water supply, etc.

The general result of the no-action alternative on socioeconomic conditions of the region and specifically Manatee County would, in effect, be one of unrealized potential economic benefits.

Economic benefits of the proposed mine, as represented in Section 5.2 Economics would be about $4.5 million in local property and state severance taxes with no appreciable effects exerted on public services, facilities, etc. Additionally, the projected $25 million annual expenditures by Swift for products and services would not be realized.

The no-action alternative would, of course, represent the loss of 61.5 million tons of phosphate rock resource. The annual production rate of 3 million tons of rock is about 8% of current Florida phosphate production.

On a greater than local or regional scale, a potential for positive impact on the United States balance of payments would be lost due to unrealized sale of the rock product, upgraded rock products and food products grown domestically.

Environment - The present day general trend for eastern, rural Manatee County to be largely devoted to agricultural activities is not expected to change in the foreseeable future. The only noticeable change to this trend, which is viewed as temporary in nature, is the approval of two phosphate mines in eastern Manatee County as Existing Sources. The two approved mines, neither of which are presently in operation, are located immediately north and south of the Swift Duette tract.

In the absence of mining on the Duette tract, it is expected that little physical modification of the tract will occur over the next two decades. Because of the relatively poor soil conditions at the Duette tract, it is unlikely that the native rangeland (cut-over flatwoods), which comprise the majority of the site, would be rapidly converted to improved agricultural uses. The practice of clearing native rangeland for production of watermelon and/or tomato crops for a few seasons may result in several hundred acres eventually converted to improved pasture. This conversion of a few hundred acres of the tract to pasture should not exert significant adverse impacts on the biology and ecology of the site. As current land clearing practices for improved agricultural use typically avoid wet soils due to the impracticality of its use as pasture or for row crops, significant destruction of wetlands on the tract is not expected.

If additional acreage is cleared for row crops and/or improved pasture as assumed, irrigation requirements would probably result in average annual withdrawals of ground-water approaching that proposed for mining. These withdrawals would be confined to the dry season only, however, and probably would result in worst case aquifer drawdowns exceeding those associated with mining on the tract.

In the no-action alternative, therefore, most if not all unavoidable adverse environmental impacts, associated with mining would not occur. The existing natural setting would continue more or less unchanged. A projected benefit associated with mining and reclamation, the improvement of soil quality and productivity potential, would also not accrue.

3.0 DESCRIPTION OF PROPOSED ACTIVITY

Swift proposes to use equipment and design generally available and practiced by presently operating mines (Figure 3.0-1). The major components of operation are large walking draglines hydraulic ore transportation via pipeline to a central washer; a feed preparation and flotation plant; wet rock storage and drying; and shipment via rail. Clay and sand wastes are (initially) disposed of in separate areas, with subsequent mixing as backfill in reclamation.

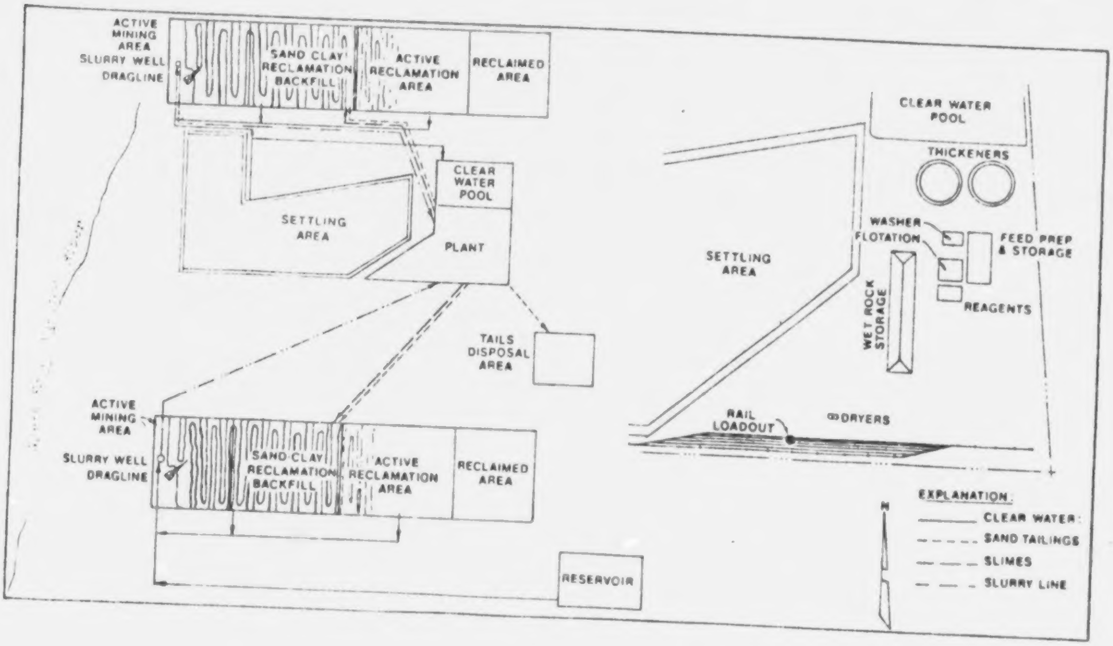


Figure 3.0-1 Mining Operation

3.1 MINING OPERATION

Figure 3.1-1 illustrates the proposed mining sequence using two draglines. The draglines strip overburden for deposit in mined-out cuts. Exposed matrix is excavated and dumped into a slurry pit or "well" -- an excavated sump within reach of the dragline. A pit control car directs high pressure water guns at the matrix breaking it into a slurry.

Pumping systems deliver the slurried matrix to the plant. A pumping system has a "pit pump", the suction of which draws the matrix slurry in the "well" into a pipeline. The pipeline transports the matrix slurry at the velocity necessary to maintain solids suspension.

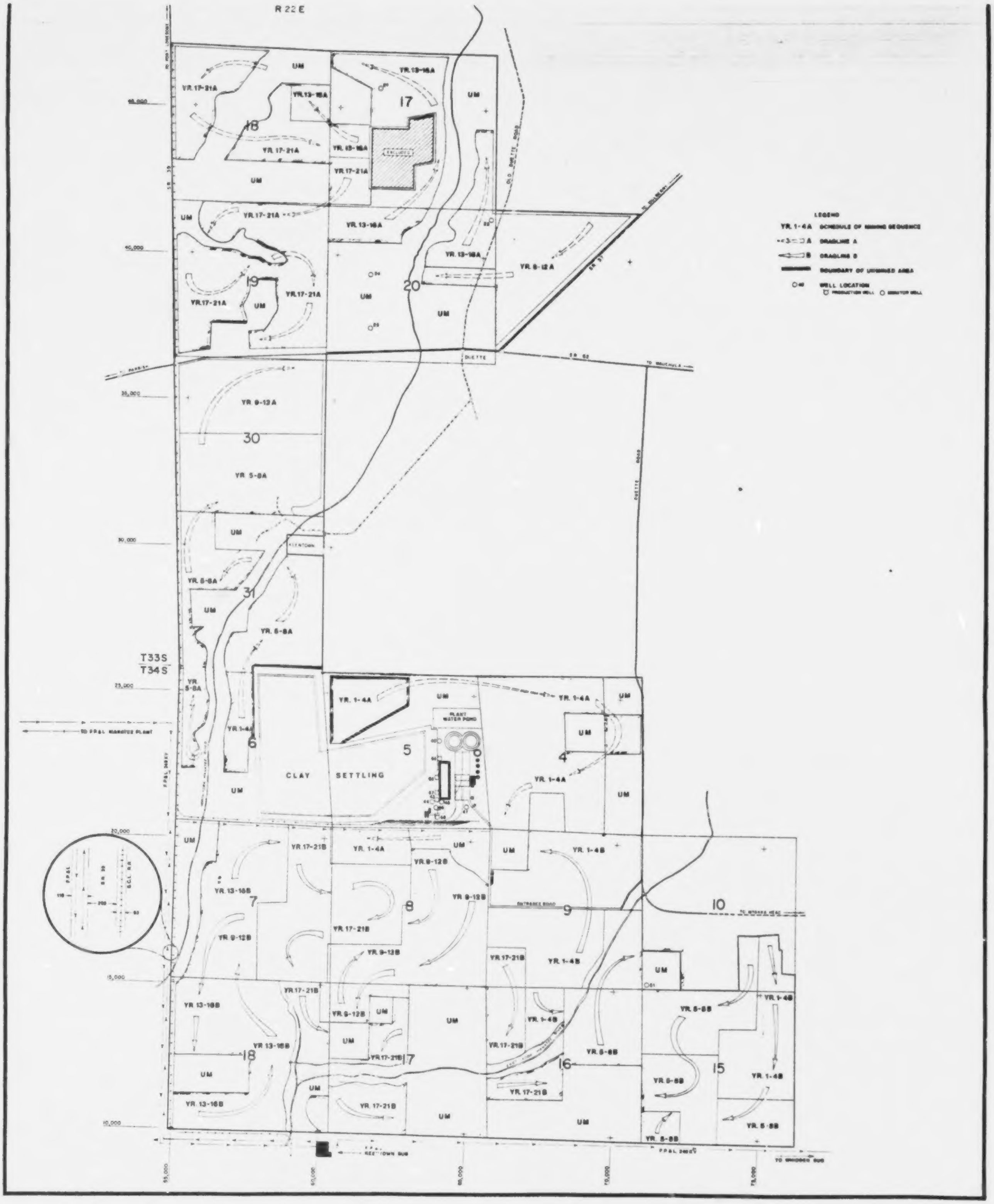


FIGURE : 3.1-1

MASTER DEVELOPMENT PLAN WITH DRAGLINE SEQUENCE

SOURCE : ZELLARS - WILLIAMS , INC.

U.S. EPA - REGION IV
DRAFT ENVIRONMENTAL
IMPACT STATEMENT FOR
SWIFT AGRICULTURAL CHEMICALS
CORPORATION
PROPOSED DUETTE MINE
MANATEE COUNTY , FLORIDA

3.2 PROCESS DESCRIPTION

Slurried matrix is passed through a wet screening process to recover the +1 mm or pebble sized material. Unacceptable pebble is discarded as waste. Product is stored in pebble bins for dewatering and quality control analysis prior to shipment or placement on storage piles.

Underflow fine material from washer screens moves to the feed preparation area where hydrocylones separate the waste clays (minus 150 mesh material) from the sand-sized particles, termed feed. The feed is transported to the flotation circuit.

Flotation is a two-stage process; "rougher" flotation separates phosphate particles from silica sand by use of a fatty acid reagent suite, followed by deoiling and "cleaner" flotation by an amine flotation of the sand particles. The sand-sized product, termed concentrate, is dewatered with water recycled to the flotation plant.

3.3 PRODUCT DISPOSITION

Wet phosphate rock is received from the concentrate and pebble dewatering bins at about 16% moisture and stored in open piles. Concentrate and pebble "rock" products are stored separately by grade and/or contaminant content to facilitate blending of rock to meet shipment specificiations, and to maintain inventory. Rock dewaters to about 13% moisture while in storage with drainage directed to the plant water system. The storage system delivers wet rock to either the dryer feed bins or the wet rock loadout bins.

The last step in processing is drying. Wet rock from the storage pile is reclaimed according to the blend of pebble and concentrate required to yield the desired chemical and physical analysis of the shipment, and delivered to the dryer feed bin by belt conveyor. The average 13% moisture is reduced to 2% in the dryer. Moisture is driven off by contacting the product with a large volume of hot air.

Dry product is transferred to concrete silos for storage. Conveyors transfer dry rock from the silos to rail loadout facilities. Approximately 2.5 million tons per year of dry phosphate rock will move by rail car to Gulf coast ports for water borne shipment to other U.S. ports or foreign ports in Mexico, Europe, and Japan. Rail shipment within Florida will account for the remaining .5 million tons per year.

3.4 WASTE DISPOSAL

The beneficiation of phosphate ore generates two solid waste products: 1) clay or "slimes" consisting of -150 mesh material and 2) sand tailings consisting of -14+150 mesh material. Traditionally the two waste materials have been transported to separate disposal areas, however, recent experimental work has been conducted on using a mixture of the two wastes to backfill mine cuts. Swift has committed in their mine plan to use a sand-clay mix in land reclamation and thereby reduce the need for traditional separate disposal areas.

At the time the mine becomes operational, Swift will select a sand-clay mix method based on the economic and technological feasibility of the choices available.

Based on current experimentation, sand and clay will be mixed in the approximate ratio of 2.5 to 1 (by weight). The mixture will be enclosed by levees averaging 14 ft. in height. The enclosed areas will be filled to 9 feet above natural grade leaving a freeboard of 5 ft. Filling above ground is necessary to allow for subsidence of the material as it dewaters and consolidates, and to facilitate gravity flow within the water return system. Approximately 5,426 acres are planned for use as sand-clay-type disposal all but 200 acres of which will be in mined-out areas.

A 480-acre conventional clay settling area is planned for the mine. This area will receive all clay wastes generated before the sand-clay mix procedure becomes operational. The settling area will remain active throughout the mine life to receive clay wastes in excess of the sand-clay mix requirements and to serve as a secondary water clarification and storage area. By the end of the mine life, the area will be filled to about 25 ft. above natural grade.

The Duette ore has sand slightly in excess of that required for the sand-clay mix. Excess sand will be deposited in mining cuts. The level of filling will be determined by drainage requirements and overburden available in protruding spoil piles to cover the sand tailings fill. In the first year of mining, sand tailings will be used to construct retaining dikes. Thereafter, about 42 acres per year will be backfilled with tailings for a total of 848 acres.

3.5 WATER MANAGEMENT SYSTEM

Water is used in ore transportation, washing, preparation of feed, flotation, and waste disposal operations. The majority of these water requirements will be supplied from the recirculation system. This initial system consists of the clear water pond, the clay settling pond, active waste disposal areas, the beneficiation plant, areas under reclamation, and ditches interconnecting these components. Water released from clay and sand wastes is recycled over and over again through this system until lost due to entrainment in wastes or products or lost to seepage into impounding embankments. The recirculation system capacity is relatively small during the early years of operation, requiring makeup water at more variable rates until the surface water reservoir and clay impoundment reservoir are developed. When the recirculation system is fully operational, approximately 89% of the total water requirements will be recycled water.

The water balance for the proposed recirculating system is shown in Figure 3.5-1. Makeup water required to offset system losses averages 11,207 gpm (16,138,000 gpd). Water within the ore accounts for 2,207 gpm of this makeup requirement. The remainder is supplied by ground water pumpage until the fourth year, when surface water diversion from the East Fork Manatee River supplies an average of 2,000 gpm to the makeup requirements, leaving 7,000 gpm of ground water.

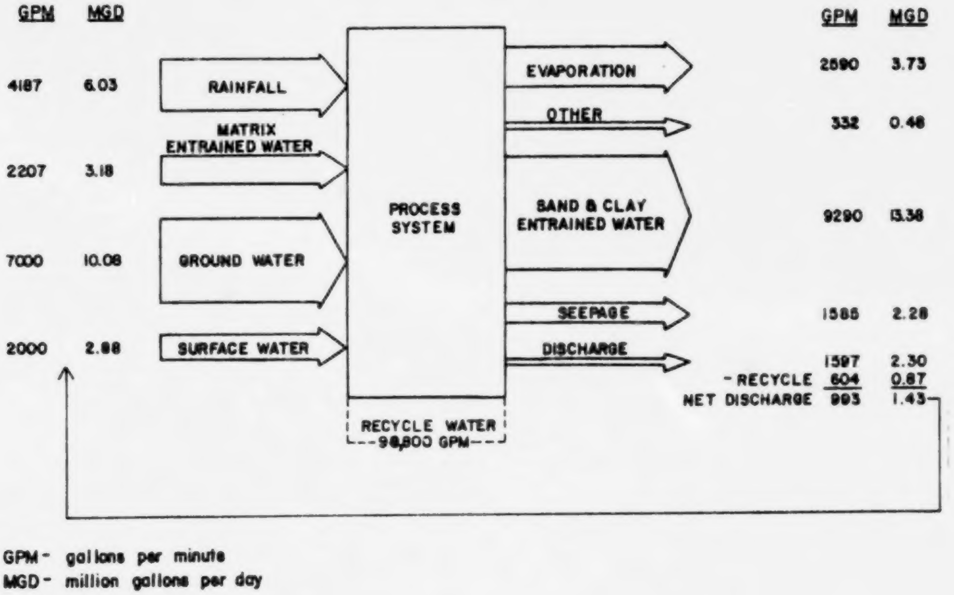


Figure 3.5-1 Process Water Balance

The water balance, mine water system, and recirculation system are based on average ore characteristics, production rates, and climatology, all of which are likely to vary annually.

3.6 RECLAMATION METHODOLOGY

Physical Restoration

With the exception of a 100-acre area, all land disturbed by the operation will be restructured and/or backfilled with waste materials in conformance with county and state slope requirements. In sand-clay mix landfills, the exterior levees and any protruding spoil piles will be graded down. Beyond conforming to slope requirements, no attempt is planned to cap sand-clay landfills.

In the clay settling area, the formation of a dry surface crust will be encouraged by the installation of perimeter and interior ditches to induce drainage. When the crust has formed, the retaining dike will be pushed down and any volunteer vegetation cleared from the area.

In sand tailings landfill areas, the overburden material in the protruding spoils will be distributed over the landfill to an average depth of two feet.

In land and lake areas, the spoils will be graded to conform with terrestrial slope requirements and to form littoral zones consisting of 12 to 1 subaqueous slopes out to a depth of 6 feet.

In disturbed natural ground areas, all facilities will be dismantled when mining is complete and the areas graded as necessary to conform to slope requirements.

In addition to these primary physical restoration techniques, several special techniques are planned to serve particular reclamation goals. A three-quarter mile segment of the East Fork Manatee River is proposed to be restored by creation of an adjacent floodplain and channel with the same elevation and gradient as the existing stream.

Shallow basins allowed to form around the drainage outlets in sand-clay landfills will be retained as marsh environments. Drainage swales will be constructed through adjacent sand-clay landfills to interconnect these marshes.

A 100-acre land and lake area has been designated as a natural restoration area. The only reclamation efforts in this area are to be the topping of spoils to eliminate peaks and the interconnection of water bodies to provide a flow-through system at high water stages.

Revegetation

About 6,000 acres of reclaimed land will be planted to forage grasses and legumes. Forage species will be selected to match the potential productivity of each reclaimed soil type.

Reforestation in upland areas will include mixed plantings of native species such as water oak, live oak, longleaf pine, slash pine, etc. in strands approximately 150 feet x 1,000 feet. In the reforestation of the 55-acre segment of the East Fork Manatee River, the soil will be stabilized by forage plantings followed by transplanting of native trees from the existing floodplain. The transplanted trees will have 2-3 years to establish themselves before the stream is diverted into the new channel. Reforestation of four major drainage swales totaling 430 acres is planned by transplanting potted and bare-root seedlings at a density of 100 trees per acre. Only native hydric trees will be used in the plantings.

Two types of reclaimed land will be allowed to revegetate naturally. The shallow basins created in sand-clay landfills are expected to be favorable environments to develop marsh-type vegetation naturally. The minimally reclaimed 100-acre land and lake area in the northeast portion of the tract will also be allowed to revegetate naturally as it is bordered on the southwest by an undisturbed segment of the South Fork Little Manatee River. The adjacent native vegetation is presumed a seed source for the natural revegetation.

Reclamation Chronology

Contouring and revegetation of land and lake areas is estimated to require two years to complete. Backfilling with sand tailings, capping with overburden, and revegetating will require about three years. In sand-clay landfills, two years has been allotted to filling, two years to subsidence and consolidation, and an additional year to revegetation, for a total of five years to complete reclamation. Because of the lengthy period required to form a surface crust, ten years has been allotted to complete reclamation of the single clay settling area.

4.0 DESCRIPTION OF BASELINE, IMPACTS, AND MITIGATING MEASURES OF THE NATURAL ENVIRONMENT

4.1 METEOROLOGICAL CONDITIONS

Temperature - The average monthly temperature for Tampa, Florida varies from 61 degrees in January to 82 degrees F in August. The winter of 1976-1977 was the coldest on record with January, 1977 being the coldest January on record. The minimum average yearly temperature on record since 1938 was 70.5 degrees F in 1969. The maximum average yearly temperature was 74.3 degrees F in 1948. The average yearly temperature based on records from 1890 to 1977 was 72.2 degrees F.

Precipitation - Data collected at two locations on the proposed mine site from 1975 through 1977 indicate an average annual precipitation of 48.03 inches. The long-term record (1890-1977) for the National Weather Service station in Tampa recorded an average annual precipitation of 48.71 inches. The maximum annual precipitation recorded by the Tampa observation station since 1938 was 70.43 inches in 1957. The minimum for the same period was 28.89 inches in 1956. Over 50% of the total annual precipitation occurs during the well-defined rainy season from June through September which is characterized by isolated thundershowers during the late afternoon and early evening hours. The maximum monthly precipitation is in August and the minimum is in November. Precipitation throughout the remainder of the year is associated with the passage of frontal systems through the area.

Evaporation - The Southwest Florida Water Management District (SWFWMD) cites an evapotranspiration (ET) rate of 39 inches per year (Water Crop, 1977) based on a study by Cherry, Stewart, and Mann (1970). A more recent study by Dohrenwend (1977) gives a rate of 34.84 inches per year. Using the SWFWMD ET rate, the ET/precipitation ratio for Tampa is 0.80. Using the more recent ET rate of 34.84 inches the ET/precipitation ratio is 0.72. These calculations are based on Tampa's annual precipitation of 48.71 inches.

Open pan evaporation rates from Lake Alfred, Florida average 69.24 inches per year for the period 1971 through 1975. This is slightly higher than the 60 to 65 inches reported by the U.S. Weather Bureau (1959) for the areas from 1946-1955. The same U.S. Weather Bureau document reports the average annual lake evaporation rate to be between 50 and 52 inches with 60-62% of this evaporation occurring from May through October.

Dispersion Phenomena - The Tampa wind pattern demonstrates a strong influence from the land-sea interaction. The winds are predominantly from the east through the year. The westerly component is more pronounced during the spring and summer than in the fall and winter when there is a stronger northerly component. The average annual wind speed for the period 1964-1969 was 7.3 knots (3.75 meters per second; 6.3 miles per hour). Wind speeds of 10 knots were exceeded 17.6% of the time.

Stability data are available only for Tampa. Atmospheric stability for Tampa is slightly unstable to extremely unstable 22.1% of the time, neutral 37.4% of the time, and slightly stable to extremely stable 40.5% of the time (NOAA, 1972).

Mixing depth of less than 120 meters occurred about 10% of the time from 1960 through 1964, and occurred most often from October through May. The average morning mixing depth for nonprecipitation cases (1960-1964) was 493 meters with an average wind speed through the mixing depth of 5.3 meters per second. The average afternoon mixing depth for this period was 1359 meters with an average wind speed of 7.8 meters per second (Holzworth, 1972).

Episode or stagnation conditions exceeding two day durations occurred about twice a year from 1960 through 1964. Episodes exceeding three day durations occurred about once every two years for the same period (NOAA, Tabulation II, 1968).

Severe Weather - The chances of a hurricane (tropical cyclone with winds in excess of 74 mph) entering the Tampa area in a given year are 1 in 20 (Dunn, 1967). The probability is less for the proposed mine site. However, the intense rains (normally 5-10 inches) associated with these storms would be likely to effect the mine site if a hurricane struck the Tampa Bay region.

The proposed mine site lies within a one degree square which had a total of 43 tornados between 1955 and 1967. During this same period, statewide, the greatest number typically occurred in June (Pautz, 1969).

The proposed mine site lies within a one degree square which had 9 hailstorms with hail 3/4 of an inch in diameter or greater from 1955-1967 (Pautz, 1969).

The proposed mine site lies within a one degree square which had 19 wind storms with wind speeds of 50 knots or greater for the period 1955-1967 (Pautz, 1969).

Tampa has about 90 days per year with thundershower activity (NOAA, 1977) and Lakeland has about 100 (NOAA, 1977). The more severe storms are attended by hail or strong winds which can inflict serious crop damage (Bradley, 1972).

4.2 AIR QUALITY

Introduction

The analysis of proposed air quality impact was performed in a manner consistent with objectives of Prevention of Significant Deterioration (PSD) and includes results of preconstruction monitoring activities, control equipment selection to achieve BACT, emissions estimates and mathematical modeling to insure conformance with PSD increments and National Ambient Air Quality Standards (NAAQS).

Methodology - The underlying methodology involved computer simulation of source emissions to determine consumption of PSD increments, and the estimation of background air quality concentrations to which source emissions could be added to determine future conformance with NAAQS. The computer simulation examined existing and future source contributions, annual and 24-hour averaging times, and the proposed as well as significant interacting external sources. Background air quality was developed from statistical analysis of measured data where necessary. Screening level analysis was used where minimal impacts were anticipated and confirmed.

For the most part, the impacts are measured on a scale of conformance with air quality standards that fully encompass public health, welfare, and aesthetic values.

Emissions Estimates - Emissions from the proposed facility were estimated from AP-42 Compilation of Emission Factors (EPA, 1973), manufacturer performance proposals and data, and projected operating factors for the proposed activity. The results of these estimates are provided in Table 4.2-A. The estimates in Table 4.2-A include both construction and operating emissions. The construction estimates comprise several elements, each a major activity period within a span of two years. As the duration of any individual element may be only six months to one year, all values taken together display a worst day representation with all activities overlapping at one time. Except where noted, the stationary source emissions are most accurate estimates in the table. The data from which these estimates were computed formed the basis for modeling source effect.

Baseline

Preconstruction Air Quality - Preconstruction air quality at the proposed project location was determined primarily from measurements, and for the case of suspended particulate, by both measurement and modeling (estimation) methods in accordance with PSD requirements. Where modeling was used, baseline values were generally determined for points at maximum pollutant effect that were identified in the analysis of impacts.

A one year program of preconstruction air quality measurement commenced in the spring of 1977 and concluded in the summer of 1978 with the purpose of measuring total suspended particulate matter (TSP), sulfur dioxide, atmospheric fluorides, and vegetative fluorides. For particulate matter and sulfur dioxide, the measurements were subjected to statistical analysis (EPA, 1971) to project values comparable to air quality standards. Results of these analyses are displayed in Tables 4.2-B and 4.2-C. Spatial averages and individual station data indicated that the existing total suspended particulate matter and sulfur dioxide levels were below air quality standards by considerable margins.

Table 4.2-A Project Emissions (Pounds Per Day)

Phase/Pollutant		TSP	Fugitive Dust	HC	NO_x	SO_2	CO	Gaseous Fluoride
Temporary/Construction								
Site Preparation		80	--	110	20	nil	660	--
Construction		60	550[a]	90	1,000	60	460	--
	TOTAL	140	550[a]	200	1,020	60	1,120	--
Operation/Mining and Processing								
Mining		10	850[a]	11	156	77	50	--
Wet Rock Storage		--	1,350[a,b]	--	--	--	--	--
Dryers		551	nil	37[c]	1,819[d]	206	185[c]	1
Dry Rock Storage and Transport		279	nil	--	--	--	--	--
Transportation (auto/truck/R.R.)		3	--	20	46	6	108	--
	TOTAL	843	2,200[a,b]	68[c]	2,021	289	343[c]	1

[a] Refer to text. Fugitive dust emissions include a substantial weight percent of coarse particulate matter (unlike dryer emissions) that will redeposit relatively close to the point of emission.

[b] Analysis of product particle size suggests methodology produces substantial overestimation (99.98% > 40 μm).

[c] Pollutant loadings generated by fuel combustion process for equivalent industrial boiler capacity. Reduced generation and/or removal may be expected in fluidized bed dryers and wet scrubbing devices.

[d] Based on field measurements conducted on a similar fluosolids dryer.

Table 4.2-B Log TSP Concentration - Frequency Estimates, 1977-78

Station	Correlation Coefficient "r"	Second Maximum 24-Hour Average	Annual Geometric Mean	Annual Arithmetic Mean
S-1	.98	82.1	25.2	27.9
S-2	.97	68.6	20.1	22.5
S-3	.98 (.99)[a]	113.5 (100.5)[a]	28.6 (27.7)[a]	32.9 (31.3)[a]
Average		83.7	24.3	
NAAQS				
Primary		260	75	(None)
Secondary		150	60	(None)
Florida Standard		150	60	(None)

a - Excluding measurement of 121.5 micrograms per cubic meter corresponding to gusty winds predominantly from the direction of a nearby dirt road.

Note: Values in micrograms per cubic meter.

Preconstruction TSP Background - The statistical analysis was relied upon to develop annual and 24-hour background TSP levels to support modeling of particulate matter impacts. An estimate of the statistical geometric mean, 25 micrograms per cubic meter, was selected as a conservative approximation of the annual TSP background level. Following the example of a previous EIS (EPA, 1978), an average of the three station 95 percentile values, 55 micrograms per cubic meter, was estimated as the short-term or 24-hour background level.

1977 TSP Baseline - PSD Review requires determination of 1977 Baseline concentration which is defined as the ambient concentration level reflecting actual air quality as of August 7, 1977, less any contributions from major stationary sources which commenced construction after January 6, 1975. The latter are charged against available PSD increments. A consequence of the definition is that the 1977 Baseline is an unmeasureable abstract quantity which must be determined by modeling. This quantity was determined for both annual and 24-hour average conditions using the AQDM and a combination of CRSTER and PTMTP-W computer codes, respectively, for several locations of worst effect identified in the source impact analysis.

The annual 1977 TSP Baseline displayed in Figure 4.2-1 reflects relatively minor influence from the 239 major sources in the 1977 Baseline inventory since there is a 25 micrograms per cubic meter background level included in the value. These values compare with federal primary and state standards of 75 and 60 micrograms per cubic meter, respectively.

The 24-hour 1977 TSP baseline displayed in Figure 4.2-2 includes

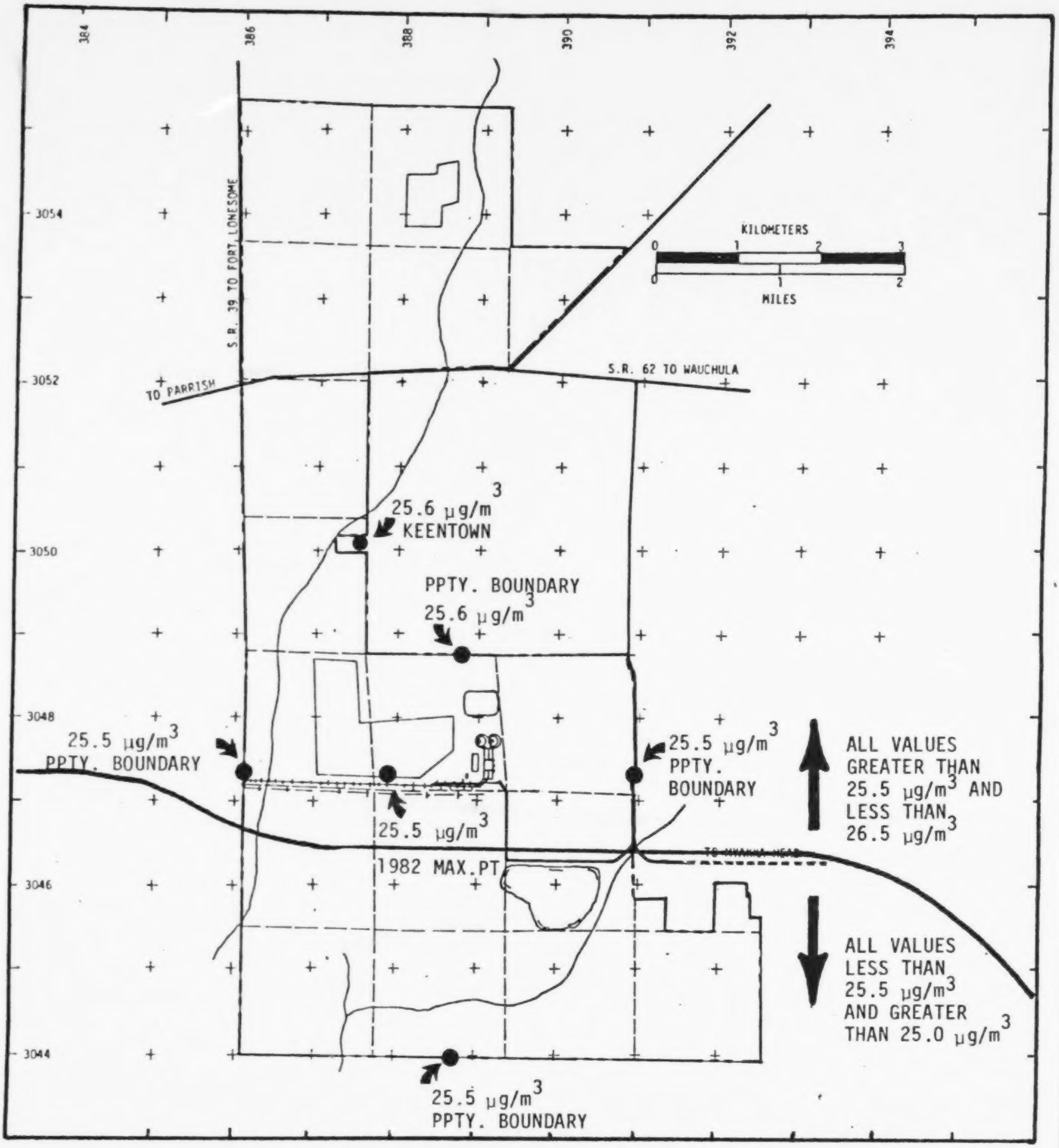


FIGURE : 4.2 - 1

ANNUAL 1977 TOTAL SUSPENDED PARTICULATE BASELINE

SOURCE : CONSERVATION CONSULTANTS, INC.

U.S. EPA – REGION IV
DRAFT ENVIRONMENTAL
IMPACT STATEMENT FOR
SWIFT AGRICULTURAL CHEMICALS
CORPORATION
PROPOSED DUETTE MINE
MANATEE COUNTY, FLORIDA

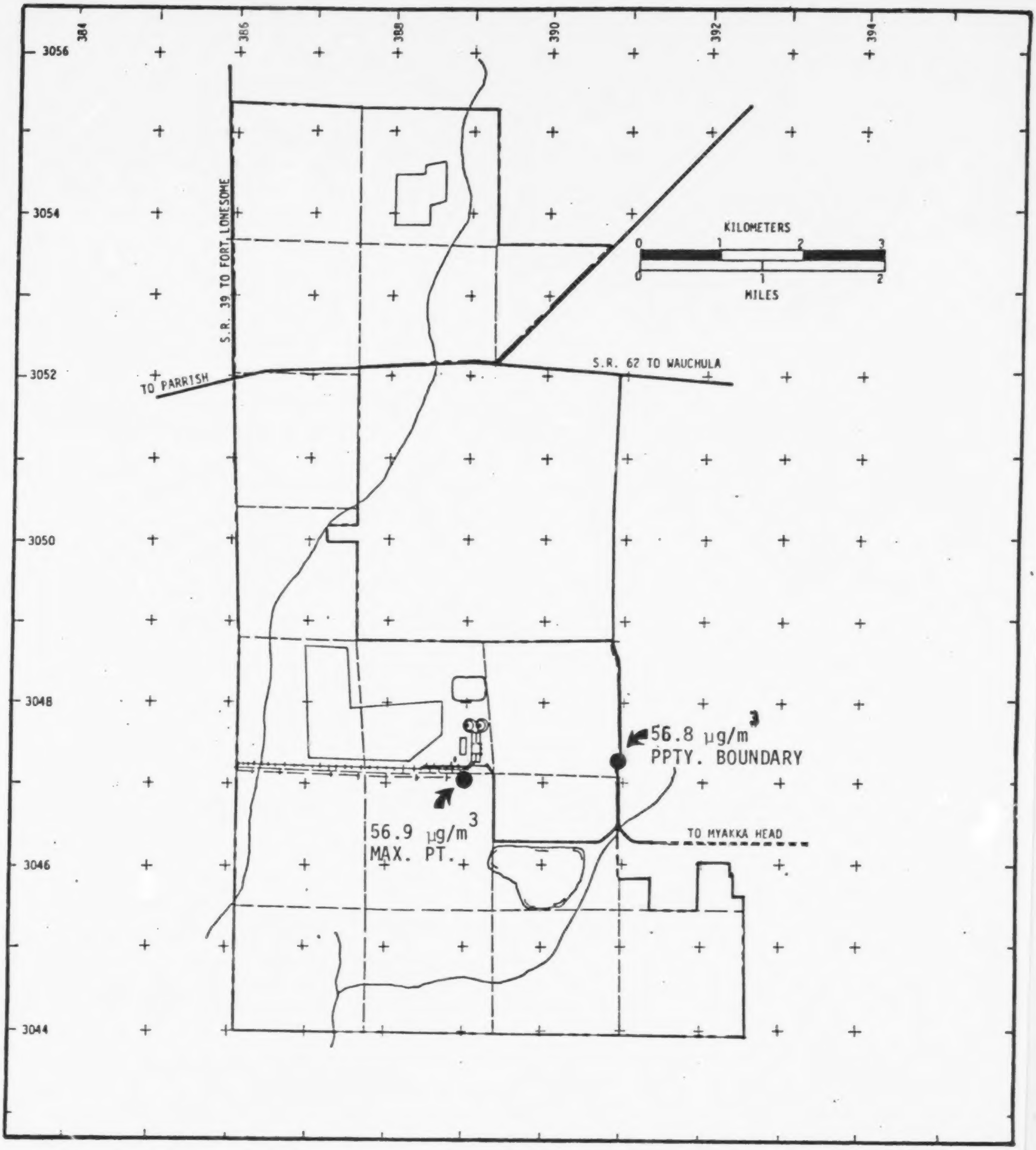


FIGURE : 4.2 - 2

SHORT TERM (24 HOUR) 1977 TSP BASELINE AT LOCATIONS OF MAXIMUM PROPOSED SOURCE INFLUENCE

SOURCE : CONSERVATION CONSULTANTS, INC.

U.S. EPA – REGION IV
DRAFT ENVIRONMENTAL
IMPACT STATEMENT FOR
SWIFT AGRICULTURAL CHEMICALS
CORPORATION
PROPOSED DUETTE MINE
MANATEE COUNTY, FLORIDA

two significant points of interest -- the locations of worst case (highest, second highest) concentration at a maximum point irrespective of the property boundaries and the comparable worst case location on a property boundary. The worst case locations were determined by intensive modeling of many combinations of sources, worst case meteorologies, and a fairly complex process of elimination of meteorological conditions not productive of maximum effect. As with the annual Baseline result, external sources had relatively minor short-term effect at the proposed project site inasmuch as the background level represents 55 micrograms per cubic meter of the values shown at maximum impact locations. These values compare with federal primary and state standards of 260 and 150 micrograms per cubic meter.

Sulfur Dioxide Baselines

The comparatively low sulfur dioxide emissions produced by the source suggested a less rigorous screening analysis would adequately insure conformance with air quality standards. A substitute baseline value was developed from 1977-78 sulfur dioxide measurements which included the effect of existing sources at the proposed site during the period of measurement. This baseline was developed from the analysis of sulfur dioxide data (Table 4.2-C) and applied to the impact analysis in a simplified fashion. The statistical projection for annual sulfur dioxide baseline was 15 micrograms per cubic meter. This value compares with federal primary and state standards of 80 and 60 micrograms per cubic meter, respectively. The projected 24-hour or short-term baseline was estimated to be 75 micrograms per cubic meter. This value compares with federal primary and state standards of 365 and 260 micrograms per cubic meter.

Table 4.2-C Log SO_2 Concentration - Frequency Estimates, 1977-78

Station	Second Maximum 24-Hour Average	Annual Arithmetic Mean
S-1	75.8	12.3
S-2	79.8	12.5
S-3	64.5	18.3
Average	73.4	14.4
NAAQS		
Primary	365	80
Secondary	260	60
Florida Standard	260	60

Note: Values in micrograms per cubic meter

Nitrogen Dioxide Baseline

Measurements conducted by others (ESE, 1975-78) at a similar rural site approximately six miles from the proposed mine suggested that area nitrogen dioxide concentrations were of the order of 10% of the 100 micrograms per cubic meter federal/state standard. Examination of concentrations in nearby urban/industrial areas indicated that the standard was not exceeded and concentrations dropped to similar low levels in the transitions from urban to rural land use. It was also determined that statistics for other pollutants measured at the mine site, e.g., sulfur dioxide, satisfied annual EPA guideline criteria (EPA, 1978A) for a remote source with a reasonable margin. All facts considered, the annual guideline value for nitrogen dioxide background (20 micrograms per cubic meter) was determined as a conservative baseline assumption for this pollutant.

Impact

Total Suspended Particulate - Long-Term Effects - Annual effects of just the proposed source were determined using the AQDM computer code. The maximum effect, 1.2 micrograms per cubic meter, occurs well within the confines of the mine. The highest property boundary effect, 0.5 micrograms per cubic meter, occurs on the west boundary. Annual effect at Keentown and the Duette area are indiscernable for practical purposes.

Annual effect of increment consuming sources are displayed in Figure 4.2-3. Annual concentration at the point of maximum effect was estimated to be 1.4 micrograms per cubic meter or about 8% of the allowable PSD increment. Estimated property boundary effects ranges from 0.4 to 0.7 micrograms per cubic meter.

Projected annual 1982 effect of all stationary sources were added to the annual TSP background of 25 micrograms per cubic meter to test conformance of the completed facility with air quality standards. The results are displayed in Figure 4.2-4. The estimated annual mean at all points of maximum effect were estimated to be less than 50% of the federal primary and state standards of 75 and 60 micrograms per cubic meter, respectively.

Total Suspended Particulates - Short-Term Effects - Short-term effects are the result of an exhaustive analysis of various proposed source/interactive source group combinations for meteorological conditions producing highest, second highest pollutant concentrations. Meteorological conditions were the result of 5 years of CRSTER analysis for source receptor distances maximizing upwind source effect and proposed source effect both at downwind locations on the property boundary and at locations of maximum effect irrespective of property boundaries. Computer simulation was performed with the PTMTP-W computer codes.

Effect of the proposed source alone were determined as follows. The 24-hour average at the point of maximum effect was projected to be 12.8 micrograms per cubic meter and the worst case property boundary concentration was 8.1 micrograms per cubic meter. The maximum point is well within the property boundaries and very close to the source cluster. Short-term effect of the proposed source at Keentown was estimated to be 4.7 micrograms per cubic meter.

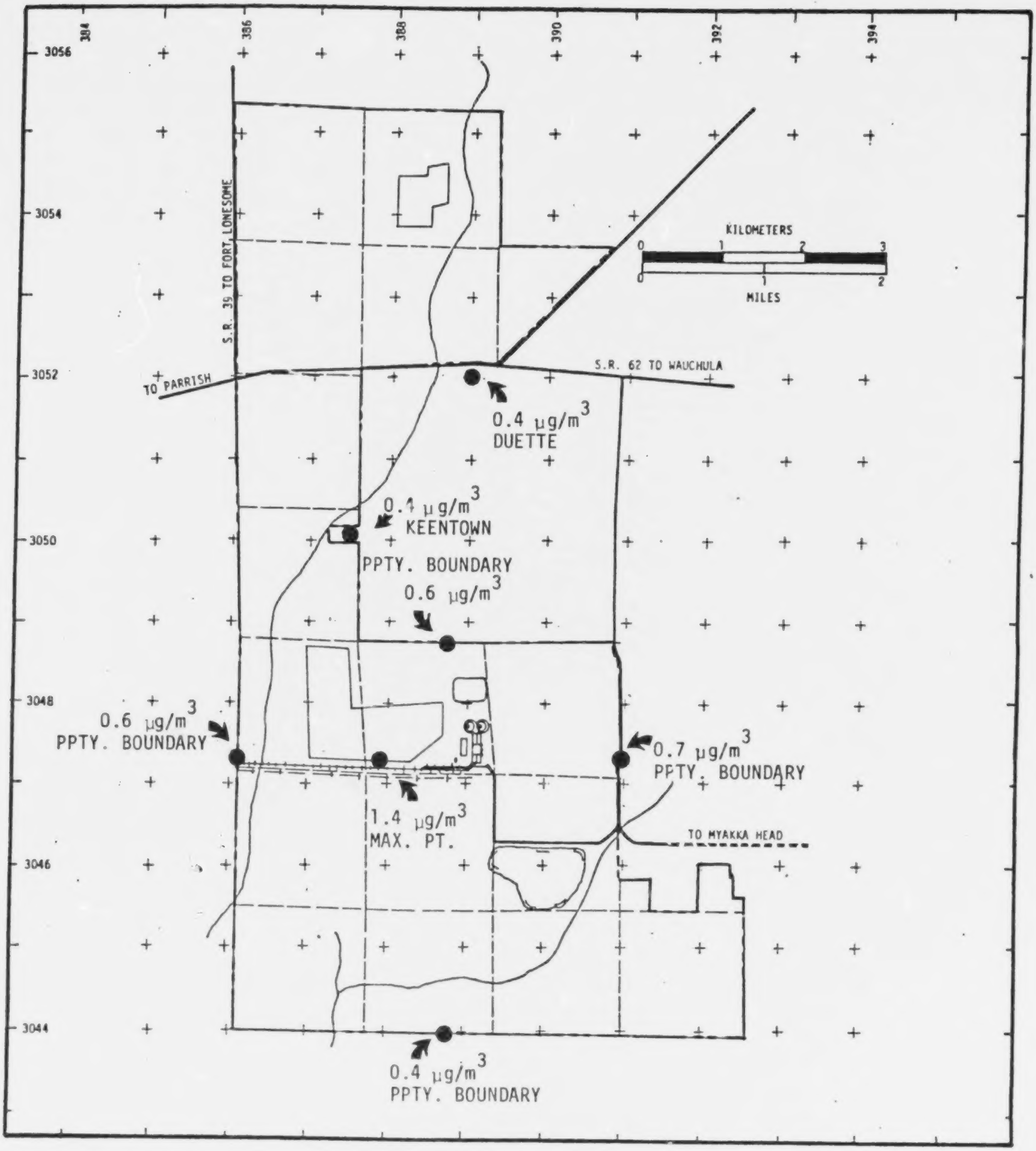


FIGURE 4-2-3

LONG TERM (ANNUAL) EFFECTS OF INCREMENT CONSUMING SOURCE PARTICULATE EMISSIONS

SOURCE CONSERVATION CONSULTANTS INC.

U.S. EPA - REGION IV
DRAFT ENVIRONMENTAL
IMPACT STATEMENT FOR
SWIFT AGRICULTURAL CHEMICALS
CORPORATION
PROPOSED DUETTE MINE
MANATEE COUNTY, FLORIDA

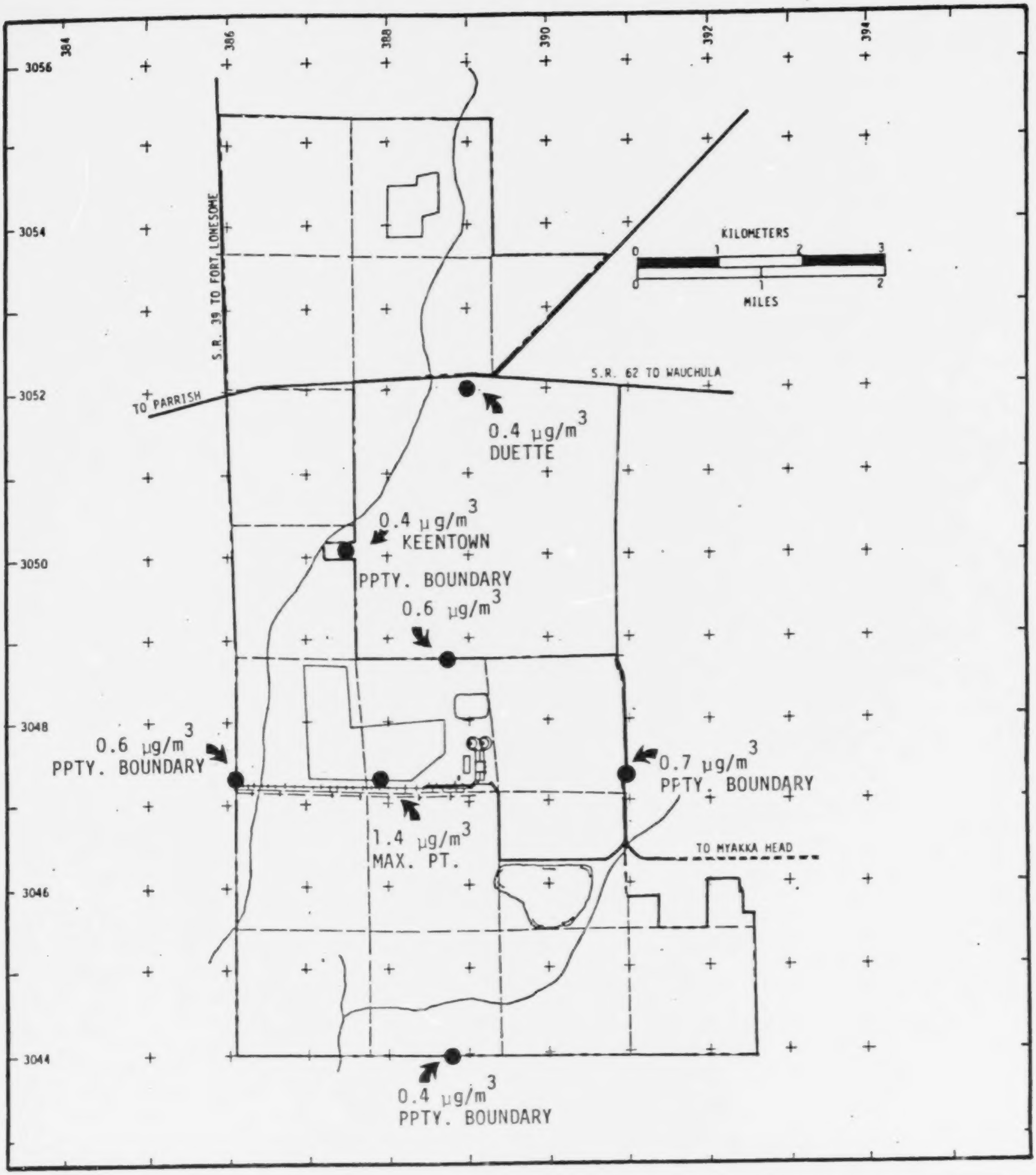


FIGURE 4.2-3

LONG TERM (ANNUAL) EFFECTS OF INCREMENT CONSUMING SOURCE PARTICULATE EMISSIONS

SOURCE CONSERVATION CONSULTANTS INC.

U.S. EPA – REGION IV
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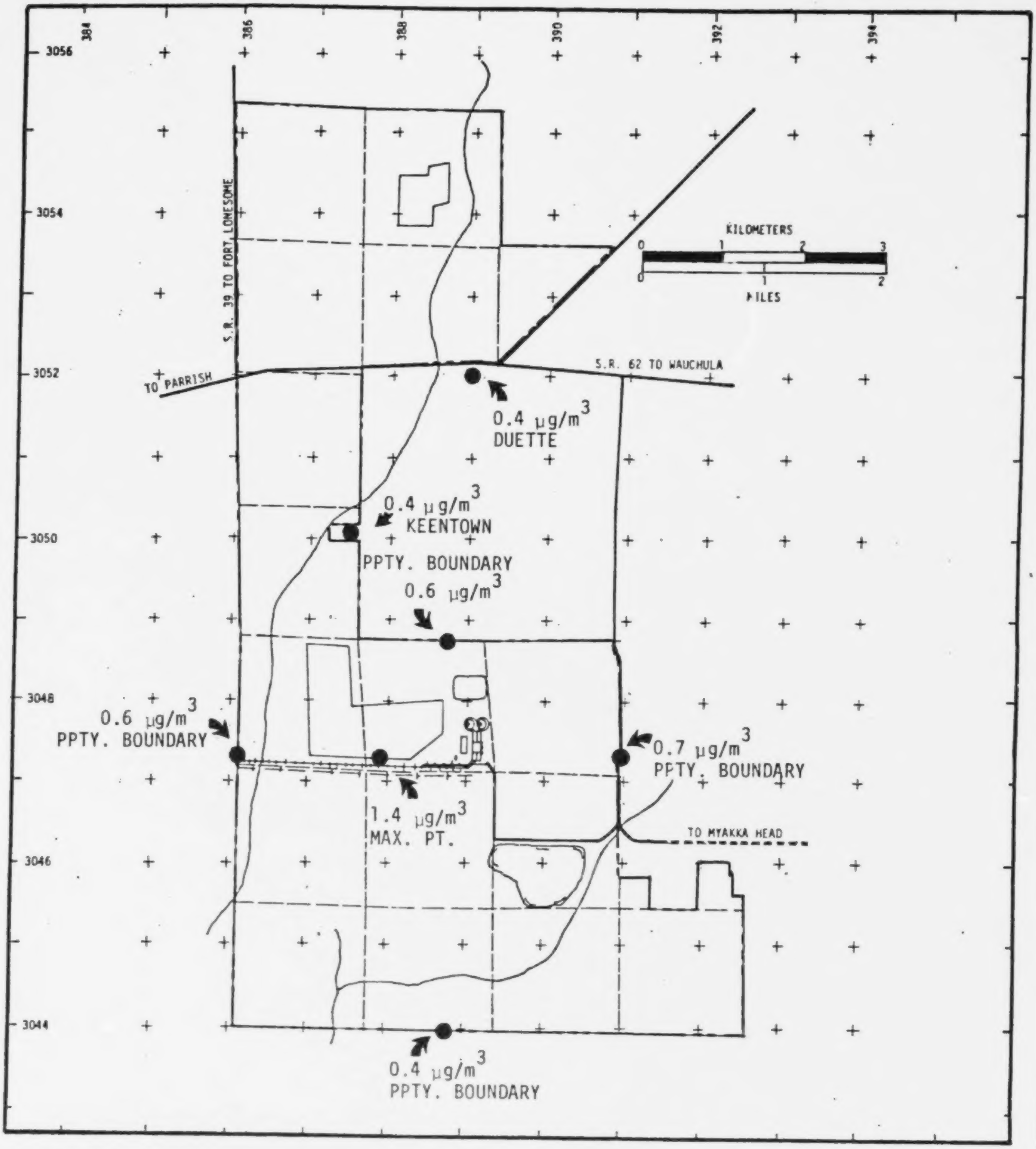
PROPOSED DUETTE MINE
MANATEE COUNTY, FLORIDA



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SOURCE CONSERVATION CONSULTANTS INC.

U.S. EPA – REGION IV
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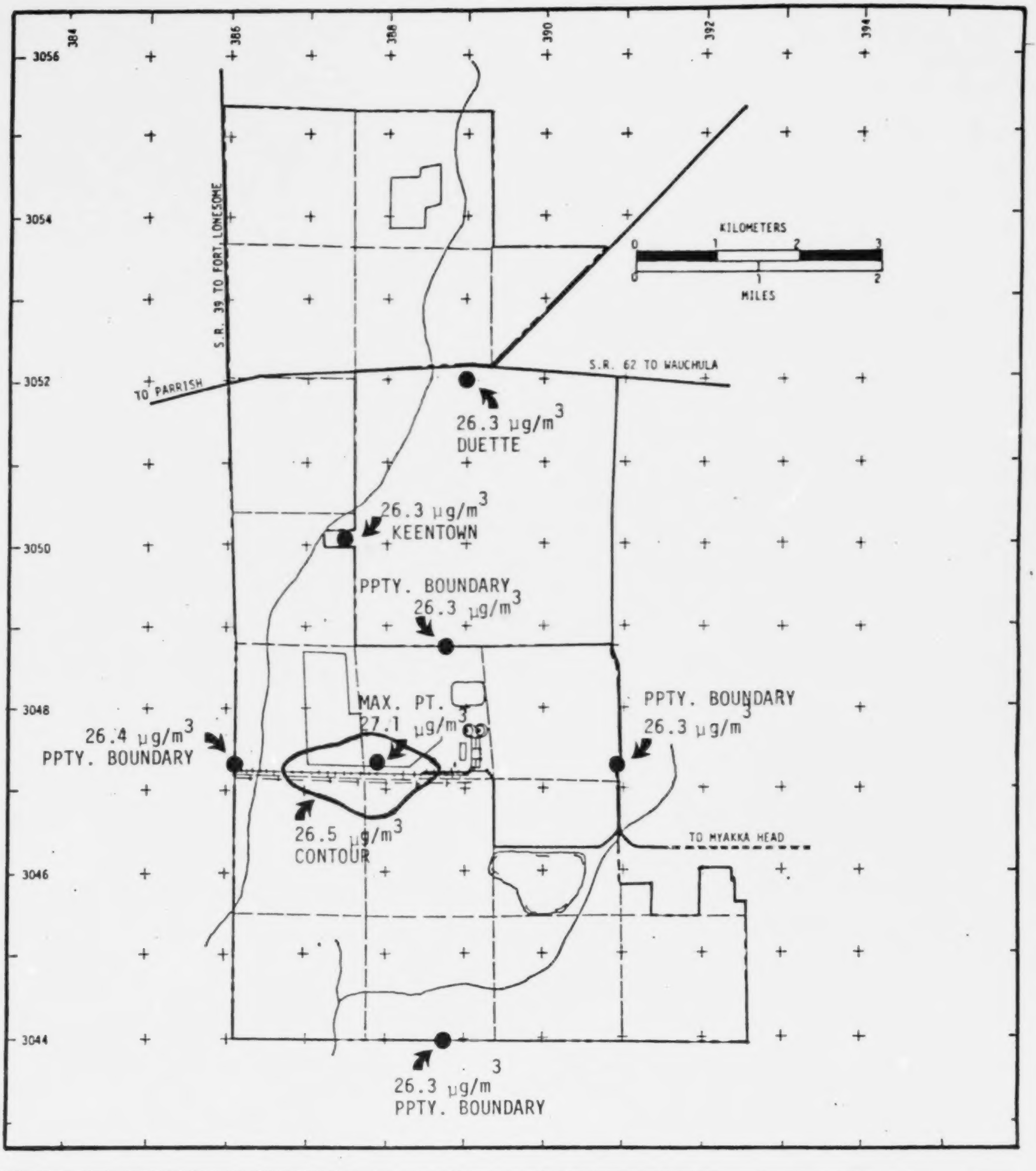

FIGURE 4.2-4

PROJECTED LONG TERM (ANNUAL) EFFECTS OF ALL STATIONARY SOURCE PARTICULATE EMISSIONS

SOURCE CONSERVATION CONSULTANTS INC.

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Effect of increment consuming sources is displayed in Figure 4.2-5. Maximum increment consumption was estimated to be 12.8 micrograms per cubic meter or about 35% of the allowable PSD increment of 37 micrograms per cubic meter. Increment consumption at the worst case property boundary was projected to be 8.1 micrograms per cubic meter.

Projected 24-hour effect of all sources was added to the short-term background of 55 micrograms per cubic meter as a means of determining conformance with ambient standards. The results are displayed in Figure 4.2-6. The estimated concentration at the point of maximum effect was 69.3 micrograms per cubic meter. It is recognized that the utility of this estimation is highly dependent on the estimate of background concentration. However, consideration of available facts would suggest that maximum 24-hour concentrations should generally be less than two-thirds of the lower of the federal primary and state standards of 260 and 150 micrograms per cubic meter, respectively.

Sulfur Dioxide Effects - Estimates of sulfur dioxide impact from the proposed source were determined from AQDM and CRSTER analysis for other pollutants, where possible, since the emission rates indicated that a screening level of analysis would insure conformance with standards. Annual average concentration at both the point of maximum effect and at the worst property boundary location were projected to be less than 1 microgram per cubic meter. The 24-hour concentration at the worst property line location was estimated to be 2.3 micrograms per cubic meter.

Property boundary values are below the PSD levels of significance of 1 and 5 micrograms per cubic meter, annual and 24-hour respectively. Results of this analysis combined with the low baseline level suggest that exceedance of the PSD and NAAQS would not be possible without other major source development in the immediate area of the proposed mine.

Nitrogen Dioxide - Estimates of nitrogen dioxide impact from the Proposed Source were determined using the AQDM computer code to test conformance with both the annual PSD level of significance and the annual NAAQS standards. Where applicable, non-stationary source emissions were approximated by an area source situated along the property boundary where stationary sources would produce the worst property boundary effect. The worst property boundary effect of the combined stationary and non-stationary sources was computed to be less than 1 microgram per cubic meter. The worst property boundary effect is less than the PSD level of significance of 1 microgram per cubic meter. Results of this analysis combined with the baseline value suggest that exceedance of the NAAQS would not be possible without other major source development in the immediate area of the proposed mine.

Effect on Soils and Vegetation - While some of the substances emitted are known to interact with soils and vegetation, ambient concentrations suggested that gaseous fluoride might be the only pollutant with potential for serious toxic effect. Trace quantities of gaseous fluoride are expected from the proposed facility, but it has been reported in another study that

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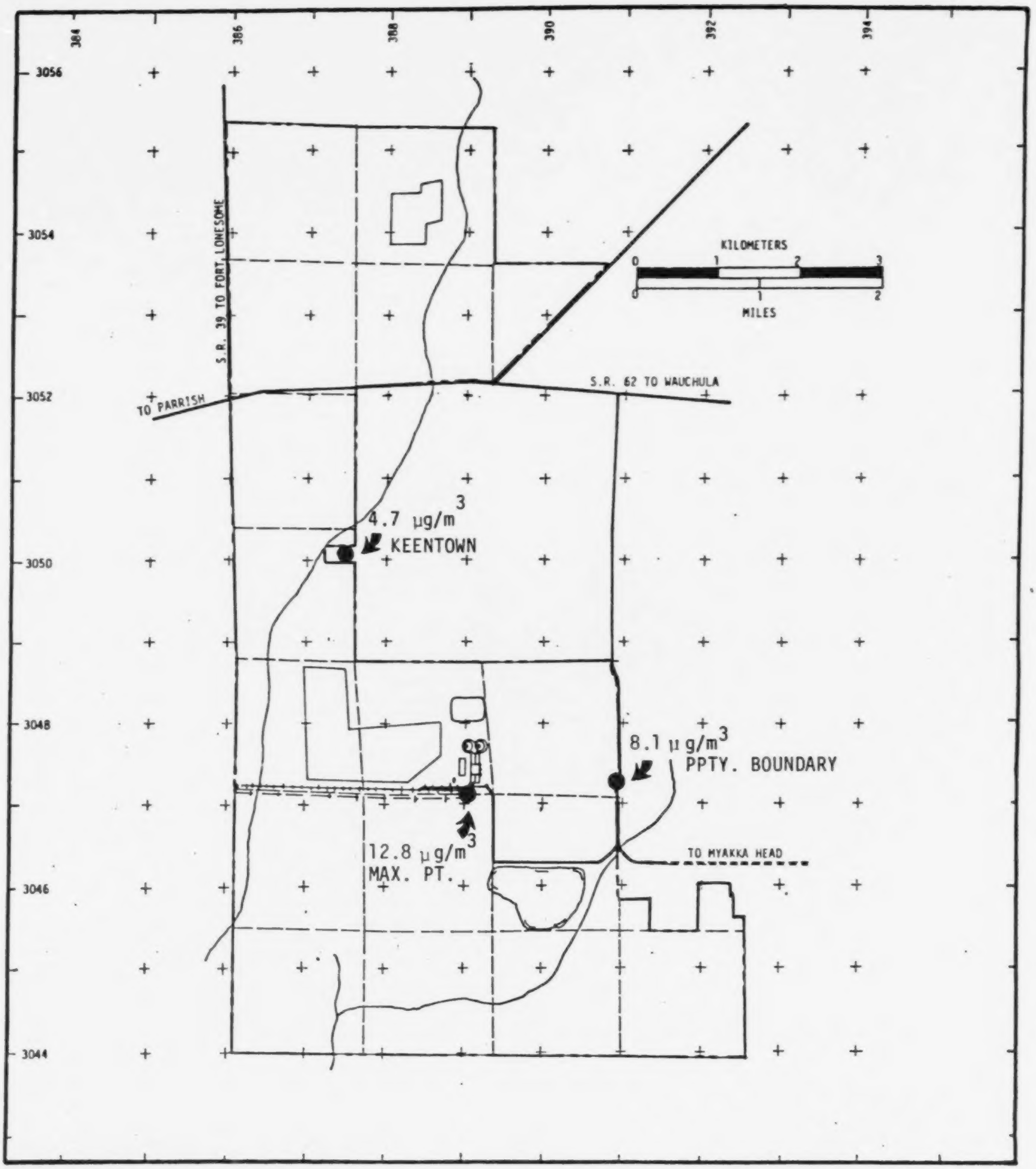

FIGURE 4.2-5

SHORT TERM (24 HOUR) EFFECTS OF PROPOSED SOURCE PARTICULATE EMISSIONS

SOURCE CONSERVATION CONSULTANTS INC.

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CORPORATION
PROPOSED DUETTE MINE
MANATEE COUNTY, FLORIDA

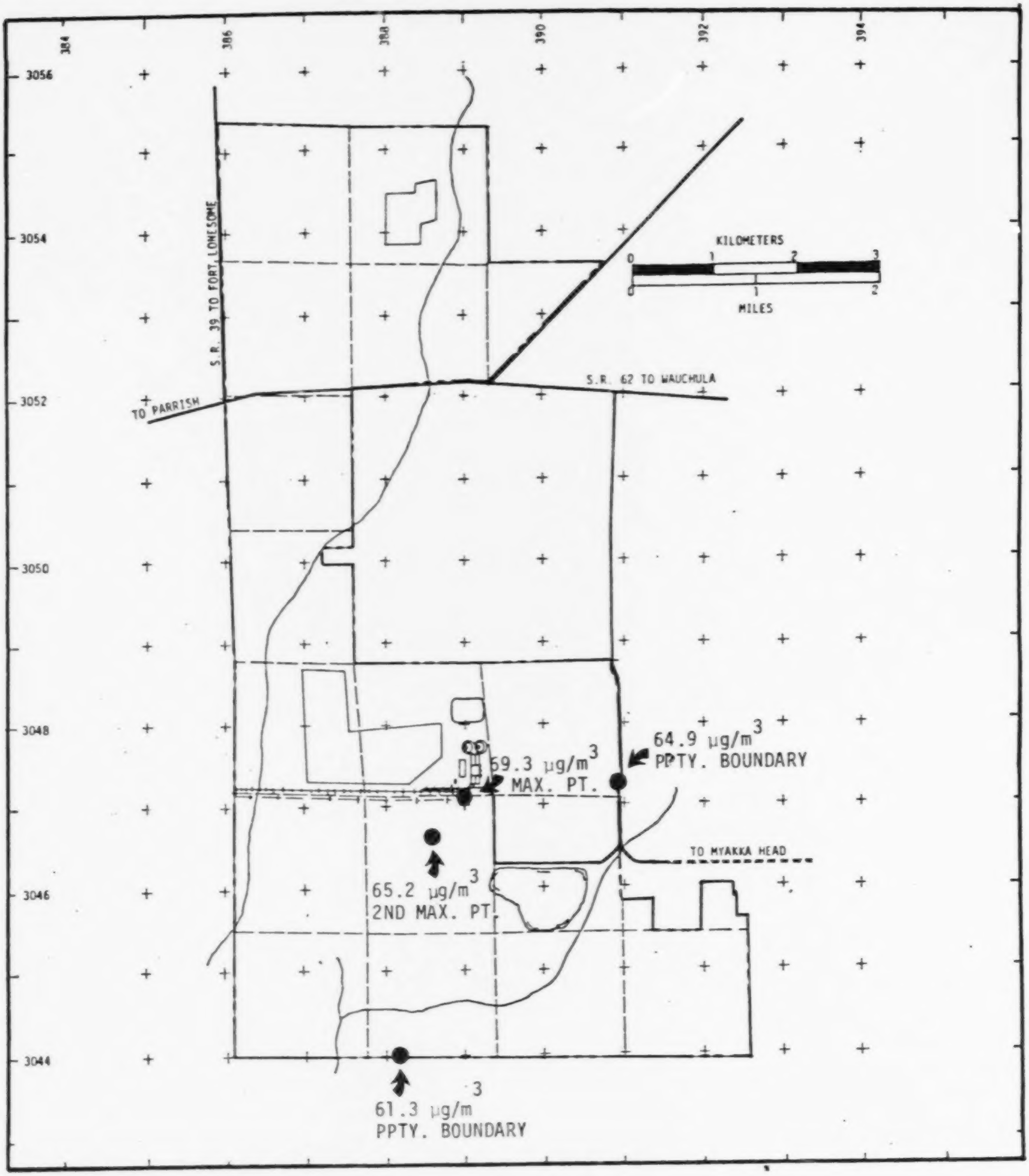

FIGURE 4-2-6

PROJECTED SHORT TERM (24 HOUR) EFFECTS OF ALL STATIONARY SOURCE PARTICULATE EMISSIONS

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PROPOSED DUETTE MINE
MANATEE COUNTY, FLORIDA

emissions several hundred times greater than anticipated have had virtually undetecable effect on sensitive vegetation types near to the source (EPA, 1978).

Effect on Visibility - Visibility effects which are regional in nature, e.g., produced by photochemical smog, condensation nuclei, etc., will be affected by the proposed source in proportion to the magnitude of all other sources, natural and anthropogenic, which contribute the same substances and/or physical pollutant forms.

The dryer stack will have a water vapor plume that will be most visible and persistent during periods of high humidity and cool temperatures, however, the landscape is not viewed as characteristically scenic and the presence of a vapor plume should not particularly affect aesthetic values. Stack heights have been adjusted to lowest reasonable levels to reduce this effect to the greatest possible degree.

The mining operations will occasionally function near roadways and high winds may occasionally entrain and carry dust from working areas across roadways. While the occurrance should be infrequent, the effects would be characteristically similar to those presently produced by agricultural interests, e.g., plowing and cultivating, in this area.

Secondary Growth Effects - Historical patterns and projected land use suggest that significant population growth and commercial activities will not accompany development of the proposed activity. Increased energy utilization is an industrial growth component for which impact has been already examined in considerable detail by regulatory interests.

Mitigating Measures

The major pollutant sources associated with the proposed activity are two phosphate rock dryers and the storage, material handling, and shipping facilities. Left uncontrolled, these operations would produce a noticeable adverse effect in a large area surrounding the proposed mining activity. An investigation of alternate high efficiency control systems indicated wet scrubber technology offered equivalent or better environmental benefit along with greatest economy and reliability, and lowest energy consumption.

The phosphate rock dryer control systems are designed to achieve as great as 99.8% removal of particulate matter (dusts), and 96.5% removal of the sulfur dioxide and an estimated minimum of 10-20% of the nitrogen dioxides generated in the combustion of fuel oil (which is necessary to dry the rock). Use of fuel oil containing no greater than 1.0% sulfur and 0.3% nitrogen will further reduce greater potential emissions which might otherwise be released by the proposed source. The storage and shipping facilities and associated materials handling systems will be equipped with fugitive dust collection systems and control devices capable of 99.7-99.8% particulate matter removal efficiency. The proposed systems will function to remove a major quantity of particulate matter sizes that have the property to remain airborne for extended periods and could otherwise travel considerable distance from the point of release.

4.3 NOISE

Baseline

A baseline noise survey was performed to determine existing sound levels at the site of the proposed Swift Duette Mine. Noise measurements were performed at seven existing receptors, including six peripheral sites and one site in an outparcel totally enclosed within the proposed mine site boundaries. The seven sites were zoned special exception land uses and included residences, a church, and school.

A minimum of two measurements was performed at each site to determine exceedance levels (Lx) and equivalent sound levels (Leq) and to estimate the day-night sound level (Ldn), L33.3, L4.16, and L2.08. Measured and estimated noise levels were then compared with applicable federal standards.

The U.S. Environmental Protection Agency (EPA) has established an Ldn of 55 dBA as a minimum requisite to protect public health and welfare with an adequate margin of safety (EPA, 1974). All computed Ldn estimates for the monitored sites were at least 3 dBA below the established guideline and the average Ldn was 48 dBA, 7dBA below the guideline.

The U.S. Department of Housing and Urban Development (HUD) has developed minimum noise standards for new construction sites (HUD, 1971). The standards are divided into three general groupings of noise exposure: acceptable, discretionary and unacceptable. Discretionary exposures may be subdivided into the categories of normally acceptable and normally unacceptable. All measurements were within the "acceptable" or "normally acceptable" categories.

The Federal Highway Administration (FHWA) has specified in FHPM 7-7-3 (FHWA, 1974) standard design noise levels for five activity Categories (labeled A through E). The residences, school, and church selected as noise monitoring sites are all included in activity Category B. The design noise levels for activity Category B are 67 dBA and 70 dBA for Leq and Ldn respectively. Measured Leq values were all at least 17 dBA within the FHWA Category B standard with an average measured Leq of 43 dBA, 24 dBA within the standard. The highest estimated Ldn was 52 dBA, 18 dBA within the Category B standard and the average Ldn was 22 dBA within the standard.

Impact

Source Measurement

The initial phase of the noise quality impact projection entailed field measurement of equivalent sound levels (Leq) and sound exceedance levels (L10, L50, etc.) at existing facilities representative of the proposed facility. Noise sources investigated included the dragline and sluice pit, washer and flotation facility, dryer and bulk loading facility, switch yard, and land reclamation activities. Source directivity, pure tones, and background sound levels were evaluated in the monitoring program.

Sound pressure levels as a function of distance were derived for each source from typical existing source measurements assuming unobstructed sound transmission (i.e., free field conditions). The noise level contribution of roadway traffic, both mine and non-mine related was estimated for the first year of mine operation (1982) in accordance with the Federal Highway Administration methods (Gordon, et al., 1971) and Transportation Noise (Nelson and Wolsko, 1973). Railroad noise levels were based on EPA's locomotive and rail car noise emission standards in 40 CFR 201.13.

Impact Analysis

The current EPA guidelines (EPA, 1974) establish annual average sound level values - an annual exterior Ldn = 55 dBA and an annual interior Ldn = 45 dBA. Twenty-four hour average sound levels were estimated and the results evaluated in consideration of annual variation and mitigative effects of attenuation contributed by ground cover (Beranek, 1971).

Cumulative noise levels in the vicinity of the property boundary were conservatively estimated by a series of peak 24-hour Ldn contours based on free field conditions to serve as a screening criterion to identify potential problem receptors. The screening indicates that outdoor noise levels at six receptors near the site would fall within the annual Ldn = 55 contour (Figure 4.3.-1).

Noise levels adjusted for ground and terrain attenuation exceed the annual Ldn = 55 criterion at only one sensitive receptor - the Dry Prairie Baptist Church, Site 1 - where a maximum 24-hour Ldn of 59 dBA is predicted. Because of the continued movement of the mining activity, the yearly average Ldn would expectedly be lower than the maximum 24-hour value.

Among the sources impacting the church, the non-mine related traffic alone on S.R. 62 in 1982 is expected to generate a 24-hour Ldn of 57 dBA at the church site. Hence, the non-mine traffic is the largest single contributor to the total Ldn at the church, and by itself exceeds EPA's outdoor criterion of 55 dBA.

EPA specifies a yearly average 24-hour equivalent sound level (Leq) of 45 dBA as requisite to avoid interference with indoor activities in educational installations (EPA, 1974). The same criterion may reasonably be applied to churches as well. Computations indicate a maximum Leq of 44 dB could be expected inside the affected church and thereby satisfy the EPA's 45 dB criterion.

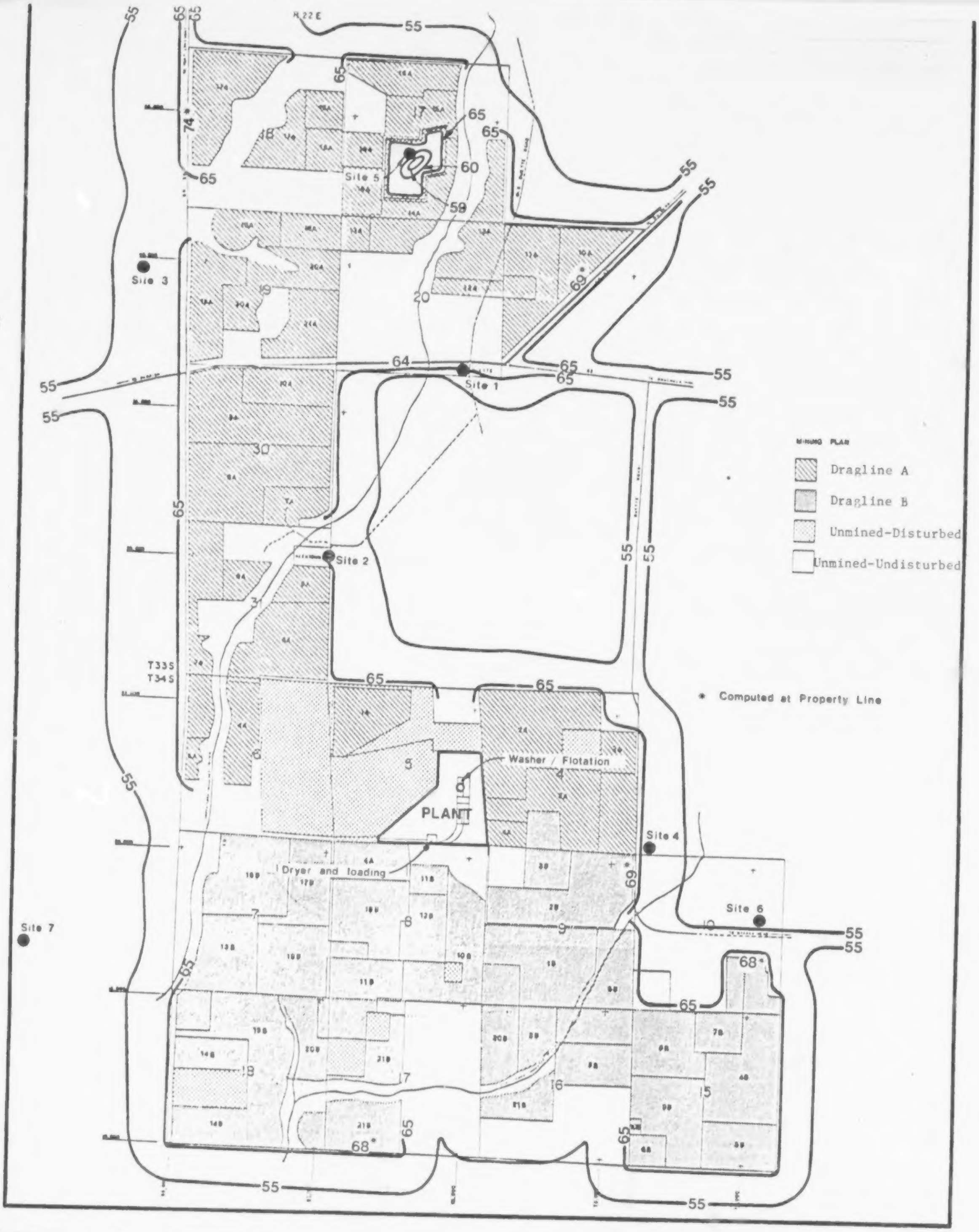

FIGURE: 4.3-1

ESTIMATED DAY-NIGHT AVERAGE SOUND LEVEL (Ldn) CONTOURS AT DUETTE MINE DURING OPERATION

SOURCE: CONSERVATION CONSULTANTS, INC.

U.S. EPA – REGION IV
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CORPORATION
PROPOSED DUETTE MINE
MANATEE COUNTY, FLORIDA

Estimated peak hourly Leq values at the church were found to be within Federal Highway Administration criteria for exterior and interior noise levels.

Further comparison of peak hourly Leq values with the U.S. Department of Housing and Urban Development L4.25 and L33.3 maximum criteria indicates that both of these criteria would also be satisfied.

Based on the noise monitoring program, there are no significant noises associated with mine-related activities that could be considered intrusive because of spectral content or intermittency.

Mitigating Measures

The noise impact assessment demonstrated that none of the sensitive receptors near the proposed mine will be exposed to noise levels which will interfere with activity or result in hearing impairment. Therefore, no mitigative measures will be necessary to protect health and welfare.

Health and safety measures taken by Swift to protect on-site personnel will comply with the requirements of 29 CFR 1910 (Occupational Health and Safety Act of 1970 and 30 CFR 70 and 71 (Federal Mine Safety Act).

4.4 TOPOGRAPHY

Baseline

Manatee County is located in the southwestern section of the Florida Peninsula with elevations ranging from sea level along the Gulf of Mexico and adjacent embayments to about 140 ft. (MSL) in the northeast corner of the county. The land surface rises monotonously inland from the coast and is moderately flat with some relief provided by shallow stream and river valleys and low sandy formations corresponding to ancient sea level terraces.

The proposed mine site is very flat with ground elevations ranging from about 125 ft. (MSL) in the north to 90 ft. (MSL) in the south. The topography is largely a result of stream dissection on a roughly level marine terrace and scattered small surface depressions which represent dolines. Figure 4.4-1 presents a topographical mapping of the site. Streams and drainage basins are described in Section 4.9, Surface Water Hydrology.

Impact

Mining will significantly alter the site's topography on the short-term through surface strip mining and waste clay disposal activities. Short term effects are primarily the strip mine land form of parallel spoil piles protruding from mined pits and dikes and dams used for waste containment/land reclamation.

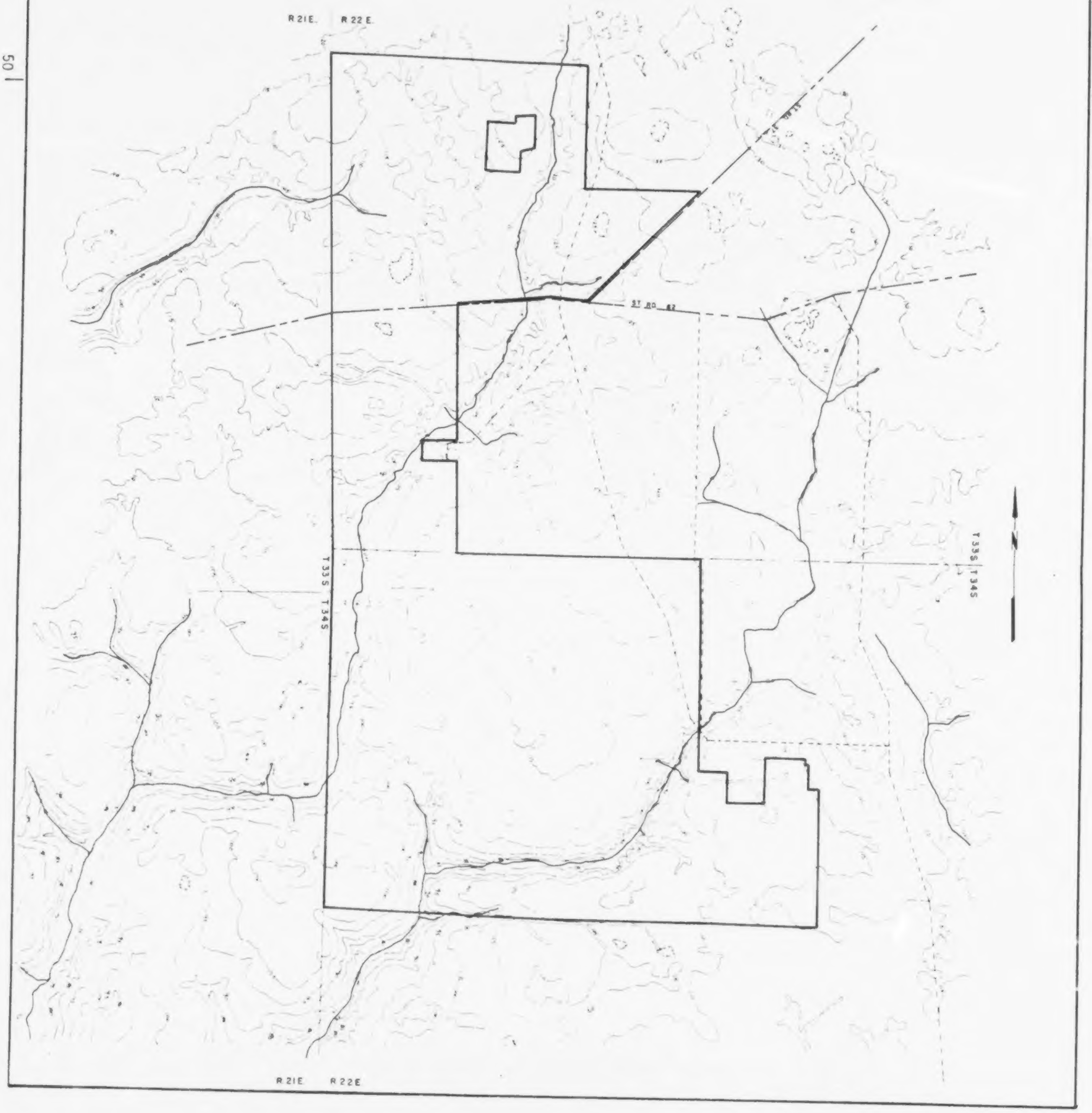

FIGURE : 4.4-1

EXISTING TOPOGRAPHY

SOURCE : ARDAMAM & ASSOCIATES, INC.

U.S. EPA - REGION IV
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PROPOSED DUETTE MINE
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The long-term, net effects on topography are directly reflected in the land forms resultant from reclamation activities which largely return the site to near pre-mining characteristics of elevation and relief. Sand-clay landfill (5,426 acres) areas are expected to be near original elevation and have a very slightly rolling topography with a very low gradient largely toward the retained, natural watercourses or created lakes. Tailings landfill will occur on approximately 848 acres and will result in an essentially flat terrain at an elevation slightly higher than sand-clay fill areas. Tailing landfill is largely planned for mined areas that correspond to the major, natural drainage divides to re-establish pre-mining watershed acreages.

Reclamation of the clay settling area (480 acres), the creation of lakes during reclamation (474 acres) and the planned abandonment of approximately 100 acres without substantial reclamation will create relief and elevation not currently found on-site. The final land form of the clay settling area will essentially be a plateau approximately 15 feet above the surrounding essentially flat terrain. The five lakes created during reclamation leave a land form not currently found on-site. A significant after mining deviation from any natural land forms found in the area will be an approximtely 100 acre area that will remain essentially un-reclaimed. This area, termed "wilderness" by the applicant, will result in permanent, parallel rows of steeply sloped island chains in the northernmost created lake.

Approximately 2,811 acres will not be mined or the existing topography disturbed in any fashion.

Mitigating Measures

Mitigating measures for topographical impacts are limited to the reclamation program which must be considered as part of the mining plan. On-going land reclamation will limit the number of acres that will be totally disrupted at any given time to about 700-800 acres.

4.5 SOILS

Baseline

The surface soils that occur on the proposed Duette mine tract are predominantly sandy in texture. Approximately 80% of the on-site soils are classified as poorly drainged. Included in this classification are the alluvial soils associated with watercourses, the freshwater swamp soils, and the soils associated with the shallow ponds on site. The majority of the poorly drained soils, however, belong to the Leon and Immokalee series in which drainage is somewhat restricted by the occurrence of an organic hardpan at a depth of 12" to 42". The remaining 20% of the surface soils are well-drained due to their occurrence in slightly more upland areas and the absence of an organic hardpan (Ardaman and Associates, 1975).

The sandy texture gives the surface soils relatively high permeability (except for the hardpan layers) and low shrink-swell potentials. The high permeability, relative scarcity of silt and clay particles, and very gradual slopes combine to give the soils low erosion potential.

In their natural state, the poorly drained soils on site have moderately high to high runoff potentials. When adequate drainage is provided, these soils are characterized by high infiltration rates and low runoff potentials. The well-drained soils on site have low runoff potentials in their natural state.

Except for the soils associated with the wetland areas, limitations for construction of low buildings are minor and relatively easily overcome. Limitations on use of the surface soils for construction of homogeneous pond embankments are considered severe. The soils can, however, be used in certain sections of embankment construction provided a core of less permeable material is provided (Ardaman and Associates, 1975).

From the edaphological standpoint, the on-site soils may be broadly categorized as acid sands with low natural fertility (Zellars-Williams, Inc., 1977). The soils associated with wetland areas have somewhat higher natural fertility; however, they have generally not been developed for agriculture due to the difficulty of draining them. The excessively drained Pomello and St. Lucie soils are generally considered too droughty for intensive agricultural use. The Leon, Immokalee, Rutlege, and Ona soils are the soils of greatest agricultural importance on the site. Though low in fertility and poorly drained in their natural state, agricultural improvements can and in some cases have been made on these soils through proper drainage, irrigation, liming, and fertilization practices. The sandy texture and relatively low organic matter contents of the surface horizons give these soils low moisture and nutrient retention capacities. Consequently, relatively high levels of irrigation and fertilization inputs are required to maintain their productivity. On the other hand, the sandy texture gives the soils good tillage and aeration properties provideing drainage is adequate.

Impact

The proposed mining operation will disturb the existing soils on 7,583 acres or approximately three-fourths of the site (Swift Agricultural Chemicals Corporation, 1978). Strip mining will totally alter the nature of the existing soils on approximately 6,624 acres. The existing soil profiles in mining areas will be destroyed and in general the surface horizons will be buried under layers of either subsurface overburden or waste materials. Disposal of either clay wastes or a mixture of sand and clay will effectively bury the existing surface soils on an additional 680 acres of land. Alterations in 279 acres of the existing soils as a result of construction of the beneficiation plant and support facilities such as the entrance railroad, mine access roads, powerline corridors, and pipeline corridors will be less severe since the soil profiles will not be destroyed.

Waste disposal and physical reclamation techniques will result in the following three new types of surface soils on the site (Swift Agricultural Chemicals Corporation, 1978):

Soil Type	Acreage
Clay	480
Sand-clay	5,426
Overburden (over sand tailings fill)	848
Total	6,754*

*The remaining 829 acres consist of disturbed native soils and land and lake areas, the land portions of which will be composed of overburden material.

Each of the new reclaimed soil types has distinct agricultural and engineering properties that relate to post-reclamation land use potential.

Due to its fine texture and content of apatite, dolomite, and feldspar, the clay soil of the reclaimed settling area can be expected to have excellent natural fertility, high moisture holding capactiy, and good nutrient retention properties. However, due to the predominance of clay and the initial absence of soils organic matter, this soil will have poor structure, and, therefore, poor tillage and aeration characteristics. Because of the prolonged subsidence that occurs as the clay dewaters, building limitations on this soil must be considered severe. The clay soil should have moderately high to high runoff potential.

Assuming that a homogeneous mixture of sand and clay is achieved in the ratio 2.5 to 1, the sand-clay soil planned for 5,426 acres of rclaimed land will fall into a sandy loam classification. Analytical results (Zellars-Williams, 1977) indicate that the soil should have good inherent fertility as would be expected from its high content of phosphatic clay. The clay content should also impart good moisture and nutrient retention properties to the soil. Initially, the soil will probably have poor structure due to the absence of soil organic mater. Tillage and aeration characteristics should, however, be significantly better than the clay alone due to the relatively high content of sand in the soil.

Sand-clay soils are expected to undergo a period of prolonged subsidence as the clay dewaters; therefore building limitations on these soils must be considered severe. The runoff potential of these soils should range from moderately high to high.

Overburden typically varies in composition depending both on natural variability and on which strata end up at the surface. Overburden soils on the reclaimed tract can be expected to reflect this variability. However, in general, overburden soils tend to be fairly high in clay and phosphorus content. As a consequence, they can be expected to have fair natural fertility, moisture holding capacity, and nutrient retention properties, though not so good as the clay and sand-clay soils. Soil structure will be poor initially, but due to the relatively high content of sand, tillage and aeration properties should be fairly good. These properties can be expected to improve as soil organic matter builds up. Overburden soils should generally have acceptable structural stability for building purposes. The runoff potential of these soils will vary from moderately low to moderately high depending on the silt and clay content of the overburden soil in question.

Mitigating Measures

The efforts to provide for productive reclaimed soils are the primary mitigative measures available to compensate for the loss of the existing soils. Even with these efforts, the short-term loss of soils from agricultural use, the initial absence of oranic matter, i.e. humus in all reclaimed soils, and the decreased bearing capacity of clay and sand/clay soils relative to the natural soils must be regarded as unavoidable adverse impacts of the proposed operation.

The primary mitigative measure to compensate for the short-term soil loss from agricultural use is to proceed with reclamation as rapidly as possible. The reclamation plan for the proposed development calls for sand/clay mix to be the primary physical restoration technique. Since this type of landfill can be expected to consolidate much more rapidly than clay alone, reclamation can proceed more rapidly than with conventional clay settling areas.

Measures available to encourage the development of soil organic matter in reclaimed soils include the rapid establishment of a vigorous vegetative cover. Except for a 100-acre area designated for natural revegetation, the reclamation plan provides for revegetation of all reclaimed soils as soon as physical stability permits and grading to approved slopes is complete. Forage plantings will account for the majority of the revegetation effort. Pasture sods, especially those including legumes, are widely acknowledged to be one of the best known ways of encouraging soil organic matter accumulation (Buckman and Brady, 1969).

The decreased bearing capacity of clay and sand/clay soils relative to the natural soils will not hinder agriculural use of these areas, but may limit other future land use options for the site. Since long-range plans call for this part of Manatee County to remain rural in nature, this limitation may not be a serious adverse impact. However, should land use plans for the area change, future developers may find it necessary to stabilize foundations with pilings or utilize other measures that increase the cost of development.

4.6 GEOLOGY

Baseline

The Swift Duette site is located within the southwestern portion of the Polk Upland physiographic province which lies between the Ocala Arch to the north and the DeSoto Plain province to the south (Cathcart, 1963). The site locality is characterized by a low topographic relief; therefore, the drainage within the site is relative poor, except near entrenched portions of the East Fork and North Fork Manatee River. The topographic surface is marked by circular depressions of various sizes and depths which represent dolines at different stages of formation (Ardaman and Associates, 1975). Limestone does not occur near the surface and sinkholes are not know to occur in the area.

The site does not contain significant surficial structural features. It is characterized by formations of Tertiary and Quaternary ages gently dipping to the south or southwest at a few feet per mile. Surficial deposits vary in thickness from 20 to 60 feet and are predominately composed of fine to medium grained sands with interbedded and dispersed clays. At a depth varying betwen 2 and 7 feet below land surface, a fine grained iron-cemented sand is commonly found which hydraulically acts as a semi-confining unit separating two layers of relatively uniform sands. In general, this semi-confining unit (locally termed hardpan) is found throughout the property but has been noted to be absent or thin at several locations. Its thickness varies from about 2 to 22 feet. Below the hardpan, sands and interbedded clays are found in thicknesses between 10 and 25 feet. Below the surficial materials is the phosphate matrix, a clayey phosphatic sand. Below the sand unit is an interbedded sequence of calcitic dolomite, dolomite limestone and sand/silty clay 250 to 300 feet thick. These materials represent the Hawthorn and Tampa formations. The lower portion of the Hawthorn Formation acts as a permeability barrier between the shallow aquifer and the deeper Floridan Aquifer. Below the Hawthorn are more competent rocks of the Tampa, Suwannee, Ocala, Avon Park, and Lake City lithostratigraphic units cited in order of increasing depth and age.

The mining section generally occurs within 50 to 100 feet of the surface and for description purposes can be subdivided into overburden, ore zones, and bedrock phases.

The overburden is of Pleistocene or Pliocene age and includes all the material from the surface to the top of the ore zone and ranges from 20 to 50 feet thick. Surface soils grade quickly into brown and gray loose clean fine sands 5 to 15 feet thick and cover the entire mine site. Where the hardpan is near the surface, it can offer a resistance to digging, hamper root penetration and downward movement of the water.

The ore zone ranges from 30 to 60 feet thick and averages 41 feet. It is composed of friable sands, clayey sands, sandy clay and clays of Miocene age containing sufficient phosphate concentrations to constitute its classification as an ore

(Zellars-Williams, Inc., 1977). This unit is assigned to the upper part of the Hawthorn Formation. With increasing depth there is a gradational increase in clay and carbonate content. The ore is sandier in texture than that typical for the Bone Valley ore of the Central District. The phosphate concentration and quality is variable both horizontally and vertically and this creates a geometrically irregular ore zone.

The bedrock represents the base of the mineable zone within the Hawthorn Formation and is generally recognized by dense and massive dolomitic limestones, often clayey, phosphatic and fossiliferous. The contact with the ore zone is often gradational. These lower formations are not amenable to ore processing as practiced on the more friable overlying materials, and generally contain smaller concentrations of lower grade phosphate. The sequence with depth contains dense clayey units that form an effective aquiclude.

Impact

In mineable areas, the upper formation will be excavated to an average depth of 50 feet and a maximum depth of 100 feet. During strip mining the overburden section of sands, clays, and hardpan will be displaced to spoil windrows within the mining pit, and the underlying phosphatic ore will be completely removed down to the "bedrock" layer. These excavated areas will subsequently be either backfilled with sand and clay process wastes or left as water-filled areas as described in the reclamation plan. Thus strip mining results in complete restructuring of the lithologic character and sequences within the mined area. Formations below the mining section will remain undisturbed.

Mitigating Measures

Surface mining will cause a change in surficial soils and the upper bed sequences that comprise the mining section on site. There is no definable impact on the overall geologic system. Geological impact, other than those addressed under more specific titles, i.e., topography, soils, hydrology, etc., would then be limited, and only unusual distinctive geologic features presently existing would require investigation. No features of such ranking are known to occur.

4.7 GROUND-WATER HYDROLOGY

Baseline

The primary source of ground water in Manatee County and at the proposed project site is rainfall which infiltrates into the ground-water system. The movement of water through the ground-water system is controlled by the hydrologic and geologic properties of the two primary aquifers occurring in the area. The shallow or surficial aquifer consists of a series of sands and clays. The deep ground-water system consists of a sequence of confining materials and an underlying thick sequence of carbonate rocks.

Shallow Ground Water - Shallow ground water at the proposed mine site is contained in the upper, or surficial materials and is found under both water table and artesian conditions.

The hydrologic properties of the surficial aquifer have been determined by pump testing and slug, or sensitivity, testing. Values of transmissivity vary over the property and average 13,000 gpd/ft. Permeability values in general are about 225 to 300 gpd/ft^2. The similarity of water levels in wells screened above or below the hardpan layer, indicates the hardpan does not act as a significant confining layer. Permeability of the matrix has been shown to be low in comparison to the overlying sands.

The average annual precipitation in Manatee County is approximately 55 inches per year (NOAA, 1977). Based upon estimates of evapotranspiration, approximately 15 to 20 inches per year are available for ground water recharge and streamflow. Calculations indicate between 1/2 and 5 inches per year are naturally recharged to the ground-water system with stream flow from the property being estimated to be about 13 inches per year.

Water levels in twenty shallow wells, screened either in the sands above the hardpan layer or those below, vary depending both upon location on the property and the seasonal effects. During the wet season, water levels are generally at or near land surface whereas during the dry season, water levels decline to about seven feet below land surface. Changes in water levels in the surficial aquifer are produced by rainfall, evapotranspiration, leakage into underlying geologic formations and base flow drainage to streams. No water-level response in the surficial aquifer has been observed as a result of the 30 to 40 feet of change seasonally occurring in the deep ground-water system.

Precipitation infiltrating the surficial aquifer will move both vertically into the underlying deep ground-water system and laterally. Vertical flow is restricted by the confining units underlying the matrix and lateral flow is restricted due to the low hydraulic gradients over the proposed project site. Calculations show the lateral flow through the surficial aquifer provides a base flow to streams of about 2 million gallons per day (2.2 inches per year).

On the mine property itself, no shallow wells were found which use the surficial-aquifer system as a source of drinking-water supply. One property owner located east of the mine uses the surficial aquifer for irrigation water and is believed to utilize this source for drinking water also, as no deep well exists on this property. Studies indicate that, with the exception noted above, no wells utilizing the shallow system for drinking-water supplies were known to exist in the project area at the time of the inventory.

Deep Ground Water - The deep ground-water system at the proposed project site consists of the limestones and dolomites underlying the surficial or water-table aquifer and the phosphate matrix.

This system includes the productive portions of the Hawthorn Formation and the Tampa, Suwannee, Ocala, Avon Park, and Lake City Formations and is commonly referred to as the Floridan Aquifer. Consistent beds of limestone and dolomite (carbonate rocks) occur from a depth of approximately 400 feet to several thousands of feet. Of these geological units, the producing zones for potable supply are found, in order of increasing supply potential, in the Hawthorn/Tampa, Suwannee, and Avon Park Formations. The Lake City, Ocala, and portions of the Hawthorn/Tampa Formations act as semi-confining units retarding the vertical movements of water in the deep ground-water system.

The Lake City Formation contains interstitial as well as layered evaporites. The inclusion of the evaporites in the carbonate rock sequence results in an extremely low permeability of the Formation. This unit contains highly mineralized water due principally to the occurrence of the evaporites and also to the residual presence of salt water associated with the deposition of the formation. A high degree of hydraulic separation of this unit from the overlying producing horizons has been determined by testing at the project site.

Recharge to the deep ground-water system occurs primarily by infiltration of rainfall into the surficial aquifer and the subsequent leakage downward through the confining beds overlying the Floridan Aquifer. The relationship of water levels in the surficial aquifer and the Floridan Aquifer throughout the project area is such that downward leakage occurs continuously. Recharge to the deep ground-water system is not restricted to the proposed project site but occurs over a large portion of the region.

An inventory of deep wells within approximately two miles of the proposed project site was made to obtain baseline information on existing supplies and use in the area. Some existing wells on the property will continue to be utilized for agricultural purposes until the proposed mining operations are initiated. Seven wells were constructed on the property to specific depth intervals and numerous pumping tests were run in order to determine both the geologic and hydrologic character of the deep ground-water system.

Aquifer testing on the proposed project site has provided values for the transmissivities and/or confining characteristics of the main hydrologic units. Of significance is the high value of transmissivity of the Avon Park Formation, the low permeability of the underlying Lake City Formation, the hydraulic connection of the Avon Park and Suwannee Formations across the semi-confining beds of the Ocala Formation and the low leakance value across the Hawthorn/Tampa Formations. Figure 4.7-1 indicates the geologic units underlying the property as identified through test-well drilling at the site and the relationship of the hydrologic characterisics of the units as determined from both geologic and pumping-test data. Specific aquifer characteristics for the various geologic units are also shown in Table 4.7-A.

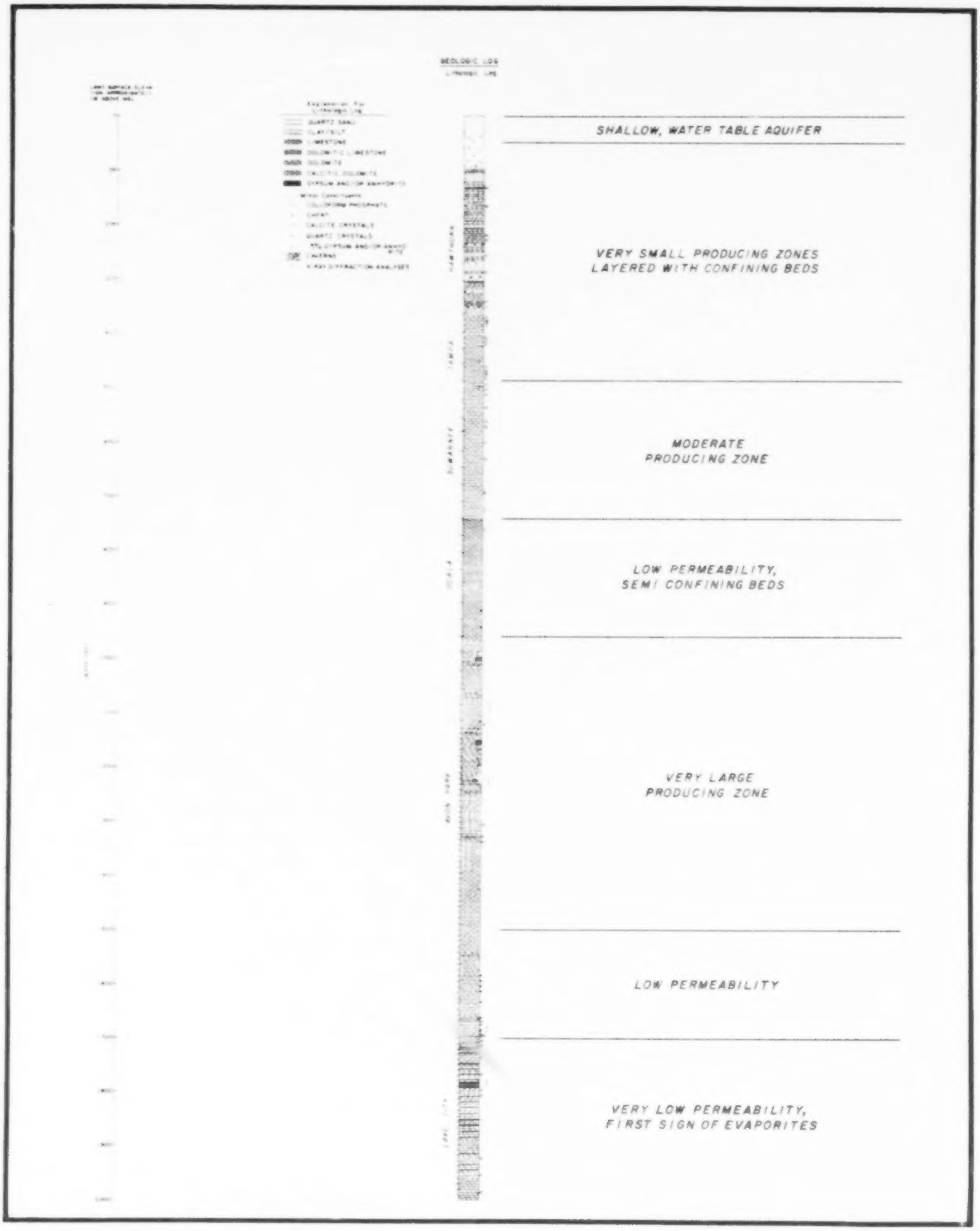

FIGURE: 4.7-1

SUBSURFACE GEOLOGY AND GROUND-WATER SYSTEMS

SOURCE: WILLIAM F. GUYTON & ASSOC.

U.S. EPA - REGION IV
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CORPORATION
PROPOSED DUETTE MINE
MANATEE COUNTY, FLORIDA

Table 4.7-A Aquifer Characteristics of the Producing (Confining) Zones

Formations	Aquifer (Confining-Bed) Thickness (Feet)	Transmissivity (GPD/Ft.)	Storage	Leakage (GPD/Ft^3)
Hawthorn/Tampa	300	---	---	.0001 to .00001[4]
Suwannee	200	25,000[1] 175,000[2]	.003	
Avon Park	500	1,000,000[1] 770,000[2] 2,000,000[3]	.003	

[1] Determined from test data. [2] Refined by use of digital modeling. [3] Estimated by use of digital model results. [4] Estimated upper and lower bounds.

Water-level elevations in the Floridan Aquifer at the proposed project site range from 30 to 40 feet above mean sea level at some times of the year to near mean sea level at other times. Generally, the direction of ground-water flow at the project area is westerly, towards the coastline.

As seen in Figure 4.7-2, the seasonal effects of irrigation in the area of the project site are reflected by variations in the potentiometric level of the Floridan Aquifer on the order of 30 feet. During the low water-level periods of the normally dry spring months, potentiometric levels in the Floridan Aquifer decline below sea level in a large area coastward of the proposed project site.

Impact

Effects of the proposed development of Swift's Duette Mine will be evidenced in both the shallow and deep ground-water systems. The effects will result from the mining operations including; pit dewatering, water-supply withdrawals and the proposed recharge and reclamation projects. Dewatering of the surficial materials to facilitate mining will, to some extent, impact the shallow ground-water system throughout most of the property at some time during the life of the mine. As the active mining moves from a mined-out area, dewatering operations, other than those associated with the recharge project, will cease and water levels in the surficial aquifer will begin to re-establish themselves to the previous conditions.

The recharge and reclamation projects will effect both the surficial and deep ground-water systems. Although the withdrawal of water for process requirements will effect the deep ground-water system, very little effect will be noted in the shallow ground-water system. Ground water from the deep system will be withdrawn in the south-central portion of the mine property. Withdrawals will be limited to those rates and locations included in the consumptive-use permit (No. 27703739) granted by the Southwest Florida Water Management District (SWFWMD) in

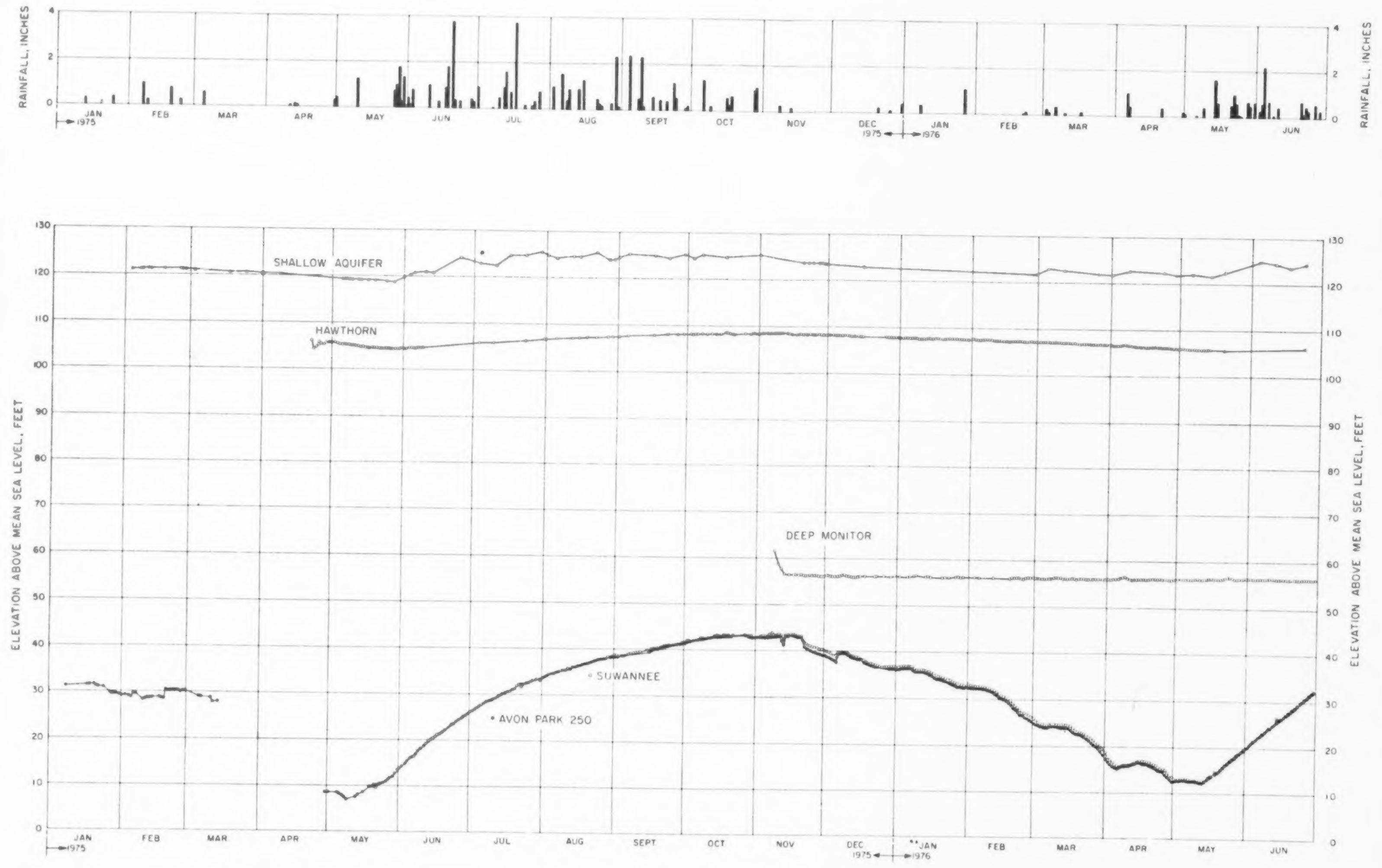

FIGURE : 4.7-2

LONG TERM WATER LEVELS
OF
INDIVIDUAL PRODUCING ZONES

SOURCE : WILLIAM F. GUYTON & ASSOCIATES

U.S EPA – REGION IV
DRAFT ENVIRONMENTAL
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SWIFT AGRICULTURAL CHEMICALS
CORPORATION
PROPOSED DUETTE MINE
MANATEE COUNTY , FLORIDA

September, 1978.

Shallow Ground Water - The surficial, or shallow ground-water system, as previously described , is a fine to medium sand aquifer with interbedded and dispersed clays. The average permeability has been calculated to be about 260 gpd/ft^2. The primary effect of the proposed action will be to lower the water level in the surficial system within the radius of influence created by both dewatering and recharge wells. Within the active mining area, the water table will be lowered to the top of the ore matrix, a maximum of about 50 feet. If significant permeability exists in the matrix, dewatering operations may require lowering of water levels into the ore body. The lowering of water levels in the shallow system will decrease rapidly with distance from the dewatering wells.

Mining will begin in the southern portion of the property, near the East Fork of the Manatee River. As this pit is abandoned, active mining with this dragline will move northward. The initial mining pit will then be modified for use as a surface water supply reservoir. Dewatering will precede the mining by a sufficient time period to preclude delaying dragline operations, the time being dependent on conditions at the individual site. The effect of a single dewatering well will extend a distance of 1,700 to 2,400 feet based upon operation of 6 months and 1 year respectively.

Tentative recharge-well locations have been presented in a report entitled "Manatee Mine Recharge Program" prepared by Swift. The recharge project will effect water levels in the shallow ground-water system within the radius of influence of each recharge well. The dewatering and recharge wells will cause a similar response in the lowering of water levels in the surficial aquifer. The results of hydrologic testing of the deep aquifer system beneath the project site indicates sufficient aquifer permeability to accept the recharged water likely exists in the Suwannee Formation and certainly within the underlying Avon Park Formation.

The proposed reclamation program will return waste clays (slimes) and tailings sands to the mined-out areas. The majority of these areas will be filled with a mixture of waste clays and tailings sands. This method of reclamation may reduce the effectiveness of recharge wells by decreasing the permeability of the property.

The projected effect of the mine operation on the regional flow pattern in the shallow ground-water system will be small in comparison to the effect on-site. On-site flow patterns within the surficial aquifer will be altered depending on the specific locations of the recharge and dewatering wells and the location of the clay, clay/sand, and sand filled areas. Of the three primary factors involved in changes in the flow within the shallow ground-water system (precipitation, evapotranspiration, and leakage), the precipitation and evapotranspiration will be insignificantly effected.

Vertical recharge (natural leakage plus induced recharge through recharge wells) will increase during the operation of the mine-recharge project but is expected to return to baseline conditions at some time after reclamation is complete if the recharge program is terminated. The reason for the return to the baseline conditions is that the vertical permeability of the underlying Hawthorn/Tampa Formations is the controlling factor of natural leakage.

The base-flow component of stream discharge will be effected by dewatering operations and recharge wells and may also be effected by the proposed reclamation project. In the proximity of dewatering or recharge wells, the infiltration capacity will increase due to the dewatering effect of the wells. The dewatering will provide additional space within the surficial materials to capture more of the precipitation than would have occurred otherwise, resulting in less base flow to streams.

Whereas dewatering and the recharge projects are temporal in nature, the extent of any effect due to the reclamation project on the base flow to streams will extend for prolonged periods of time, and will be dependent upon the permeability of the replaced materials and the proximiy to the streams. Although the permeability of the reclaimed areas will be altered to some extent, the combined surface and subsurface flow from the property will return to near the baseline amounts. There will, however, be a change in the distribution of the percentages of each.

Deep Ground Water - The baseline information regarding the deep ground-water system describes the aquifer characteristics determined during the extensive drilling and testing conducted on the property. Utilizing these characteristics, effects of the proposed withdrawals can be determined. The primary effect of withdrawals from the deep ground-water system is the lowering of the potentiometric surface within the area of influence of the wells.

The schedule of withdrawals is included in the consumptive-use permit granted by the SWFWMD. This allows for withdrawals from the deep ground-water system at a rate of 13 million gallons per day (mgd) for the first 3 years of the mine's operation. During these 3 years, Swift is required to construct a surface-water retention area that will provide 3 mgd. Commencing in the fourth year, the use of surface water will result in a decrease in the ground-water requirement to 10 mgd. Prior to the initiation of withdrawals, the SWFWMD permit requires the construction of sufficient recharge wells to transmit 3 mgd of water from the surficial aquifer into the deep system. The effect of the recharge project will be to off-set the withdrawals from the deep grourd-water system by 3 mgd thereby decreasing the net impact on the Floridan Aquifer.

The withdrawal points (well locations) are shown on Figure 4.8-1 of the following section. The locations were selected to reduce the projected effect of the withdrawals outside of the mine property. The recharge points proposed by Swift are also shown in Figure 4.8-1. When actually constructed, the recharge wells may be located at points other than those shown. In general, however, the locations shown are sufficient for the projection of effects. Proposed average recharge rates have been obtained from information included in the Swift DRI Addendum and the total recharge requirement as specified by SWFWMD.

As proposed in the recharge project portion of the Swift DRI Addendum, the water in the surficial aquifer will be diverted to the deep ground-water system by use of recharge or connector wells. The preliminary design of these wells indicates that they will be cased to a depth of 150 feet with open hole extending to 700 or 800 feet. This design should allow the water to be accepted by the Suwannee Formations, depending somewhat on the head relationships and formation permeabilities. Both the Suwannee Formation and the underlying Avon Park Formation are capable of receiving the expected quantities of recharged water.

The effect of the scheduled net withdrawals is at a maximum at the end of the first three years of operation of the proposed mine. At this time, the maximum decline of the potentiometric surface on the mine property is expected to be about 12 feet and at the closest property boundary about 3.7 feet. These figures decrease to about 9 and 2.6 feet respectively when surface water becomes available beginning in the fourth year and net withdrawals decrease by 3 mgd.

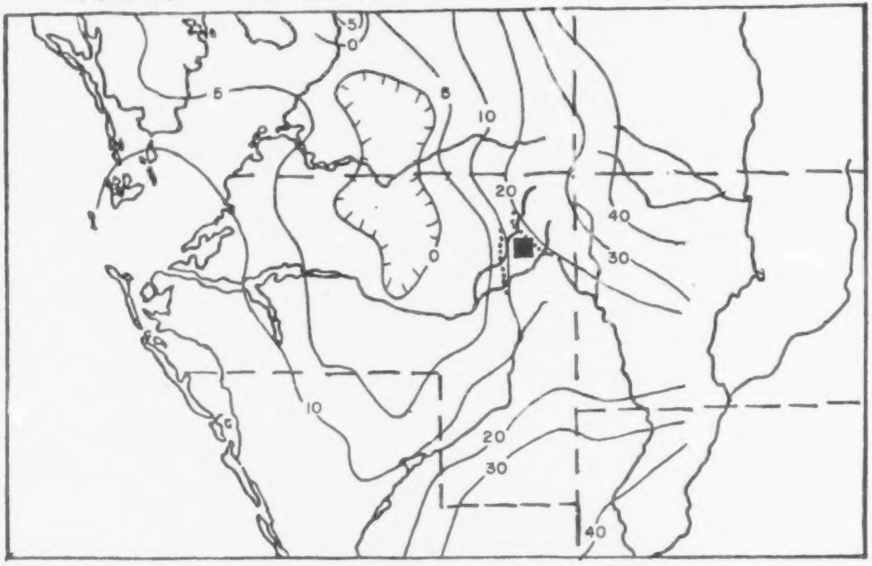
The effect of the proposed withdrawals on the potentiometric surface is extremely small in comparison to the large seasonal fluctuation illustrated in Figure 4.7-2. Figure 4.7-3(a) is the calculated potentiometric surface at the end of the first 3 years of operation (the maximum drawdowns) as added to the May 1978 potentiometric map prepared by the U.S. Geological Survey. The May map is representative of the dry season and, therefore, usually representative of the lowest annual potentiometric surface. A similar map of the wet, or high potentiometric surface season (September 1977), is shown as Figure 4.7-3(b). The effect of the scheduled withdrawals from the deep ground-water system on the regional potentiometric surface is small.

Mitigating Measures

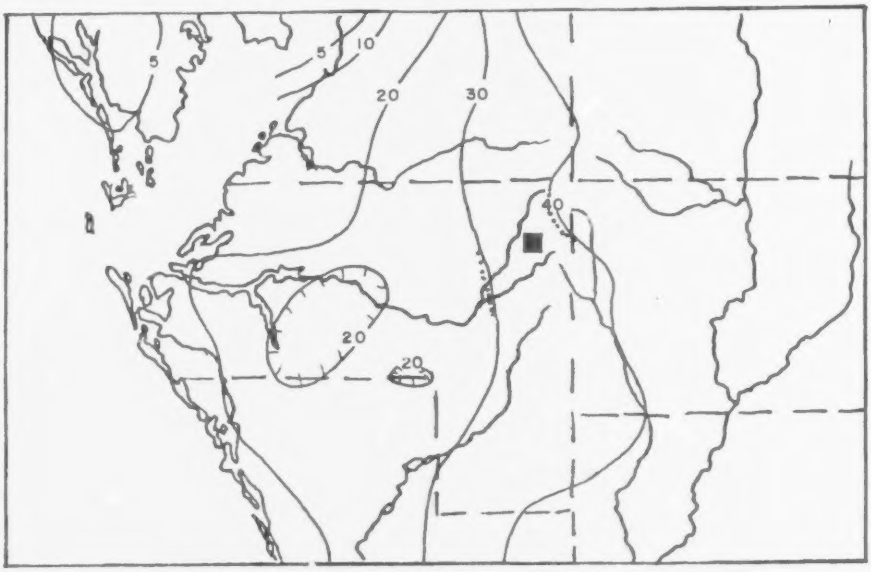
Mitigating measures on the effects resulting from the proposed mining operations are primarily included in the terms and conditions of the SWFWMD consumptive-use permit (No. 27703739). This permit was granted on September 6, 1978, and expires September 5, 1984. The permit includes details of well locations and pumpage rates in the deep ground-water system and places restrictions upon effects in both the shallow and deep ground-water systems. The permit also requires the construction of a recharge-well system for the purpose of recharging 3,024,000 gallons per day (average annual) from the unconfined surficial aquifer and/or secondary artesian aquifer to the Florida Aquifer.

Shallow Ground Water - The primary effect of the proposed action

POTENTIOMETRIC SURFACE OF THE FLORIDAN AQUIFER



(a) MAY 1978-LOW WATER LEVEL PERIOD



(b) SEPTEMBER 1977-HIGH WATER LEVEL PERIOD

——— Original Potentiometric Surface
······· Generalized Change
■ Mine Location

FIGURE : 4.7 - 3 (a) (b)

GENERALIZED CHANGE IN THE POTENTIOMETRIC SURFACE AS A RESULT OF A 10 MGD NET WITHDRAWAL

SOURCE : LEGGETTE , BRASHEARS & GRAHAM

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on the shallow ground-water system is the lowering of the water level within the system by the dewatering and/or recharge wells.

The consumptive-use permit and the rules and regulations of the SWFWMD limit effects within the shallow ground-water system to less than 3 feet of lowering outside of property which is not owned, leased or otherwise controlled by the applicant.

No provisions are included within the permit to monitor water levels in permanent wells screened in the shallow ground-water system. Such a monitoring plan would appear to be necessary to determine the lateral effect of the recharge/dewatering systems and to determine any change in the effectiveness of the recharge program as reclamation of the mined-out pits increases. Likewise, no provision is included which identifies the expected life of the recharge program. The regional ground-water manager, the SWFWMD, may wish to extend the program indefinitely as a mitigative measure for the large withdrawals which are taking place within the region. The continuance of the recharge program considerably past the life of the mine will result in a continuation of the lessening in base flow available.

Deep Ground Water - The primary effect of the proposed action on the deep ground-water system is the lowering of the potentiometric surface resulting from the withdrawals of water for process needs. Paragraph 6 of the consumptive-use permit limits the total withdrawal from the property to a "maximum combined average annual withdrawal of 12,960,000 gallons of water per day, with a maximum combined withdrawal rate not to exceed 20,480,000 during a single day." Mitigating the effect of this withdrawal is accomplished within the framework of the consumptive-use permit by requiring the direct recharge of the deep system with water from the overlying shallow system. The result of the recharge is to reduce the net withdrawal from the deep system.

To monitor the effectiveness of the recharge wells and to ascertain compliance,the permit, provides for flow measurements, to "be performed on each of the connector wells immediately upon completion of construction and then once a month thereafter unless otherwise approved in writing by the District Staff".

An additional lessening of the amount of water withdrawn from the deep system will come as a result of the use of a surface-water reservoir located on the East Fork of the Manatee River in the southeast portion of the mine property. The consumptive use permit requires that "commencing with the fourth (4th) year of mining operations, the permittee shall decrease its ground-water withdrawals by withdrawing water from the Storage Basin, when available".

The permit requirements are sufficient to limit withdrawals from the ground-water system to amounts and locations which should not pose any threat to the aquifer.

4.8 GROUND-WATER QUALITY

Baseline

Distinct differences occur in the chemical characteristics of the water in the shallow and deep ground-water systems both on the property and in the region in general. Chemical analyses of water samples collected from wells in both aquifer systems are shown on Tables 4.8-A and 4.8-B. The sampling locations for the shallow and deep ground-water systems are identified on Figure 4.8-1. The potable production horizons of the deep ground water system are underlain by evaporite deposits containing highly mineralized water and high chloride water is known to exist in areas along the coast, to the west of the project site.

Shallow Ground-Water Quality - The ground-water quality in the shallow or surficial aquifer over the project site has been sampled and analyzed at four locations. Two of these wells were constructed as part of the testing program carried out by Swift and two are existing wells; one used for livestock watering and one for garden irrigation. Figure 4.8-1 shows the location of these wells.

The chemical analyses of water samples from the surficial aquifer throughout the region generally show the water to be soft, low in chloride content except in areas of brackish or saline waters, and often with relatively high iron concentrations. As seen in Table 4.8-A, water-quality from Wells North and South Shallow meets the recommended or mandatory drinking water standards except for hydrogen sulfide, iron, pH and odor. Well North Shallow also exceeds the recommended turbidity standard. Water samples from Well W-C and W-H also meet the recommended drinking water standards except for pH and total coliform as seen in Table 4.8-B.

Evidence in the analyses of water samples from the four wells shows that two, North Shallow and Well W-H, are located at sites that have been or are presently being fertilized.

Total Coliform reported in water samples from Wells North and South Shallow are low whereas the count for Well W-C and W-H were reported as "too numerous to count", indicating the coliform was many times the mandatory drinking water standards.

Deep Ground-Water Quality - Several zones or hydrogeologic units comprise the deep ground-water system at the project site and the region in general. In order of increasing depth are the Hawthorn/Tampa, Suwannee, Ocala, Avon Park, and Lake City Formations. With the exception of the Lake City, these formations, which make up the Floridan Aquifer, and are the primary sources of potable supply for the majority of municipalities in the region as well as the source for most irrigational and industrial requirements. Typically these waters are relatively hard, clear, occasionally odorous, with low chloride concentrations except in areas of saline ground waters near the coast. At the proposed project site, comprehensive chemical analyses were obtained of water samples withdrawn from

Table 4.8-A Ground-Water Analysis Results - Installed Wells

		Drinking Water Standard[1]		Hawthorn	Suwannee	Avon Park	South Shallow	North Shallow
Inorganic (mg/l)								
Calcium	Ca	200	W	53	57	58	3.2	19
Magnesium	Mg	125	P	19	17	17	1.0	5.3
Sodium	Na	200	C	12	14	8.3	6.1	4.1
Potassium	K			1.48	1.98	1.37	0.19	0.62
Carbonate	CO_3			0	0	0	0	0
Bicarbonate	HCO_3			268	195	168	12	76
Sulfate	SO_4	250	E2	2	62	73	2	3
Chloride	Cl	250	E2	4	11	10	9	5
Silica	SiO_2			25	25	14	4.3	6.2
Hydroxide	OH			0	0	0	0	0
Carbon Dioxide	CO_2			23.47 [2]	3.49 [2]	2.99 [2]	5.99 [2]	54.93 [2]
Hydrogen Sulfide (H_2S) as	S	0.05	E2	7.6 [2]	0.42 [2]	1.01 [2]	0.10 [2]	0.34 [2]
Ortho Phosphate	PO_4			0.22	0.07	0.09	0.90	7.66
Iron	Fe	0.3	E2	0.05	0.18	0.07	0.31	0.74
Copper	Cu	1.0	E2	<0.1	<0.1	<0.1	<0.1	<0.1
Manganese	Mn	0.05	E2	<0.05	<0.05	<0.05	<0.05	<0.05
Zinc	Zn	5	E2	<0.1	<0.1	<0.1	<0.1	<0.1
Arsenic	As	0.05	E1	<0.01	<0.01	<0.01	<0.01	<0.01
Barium	Ba	1.0	E1	<0.5	<0.05	<0.5	<0.5	<0.5
Cadmium	Cd	0.01	E1	<0.01	<0.01	<0.01	<0.01	<0.01
Chromium	Cr	0.05	E1	<0.01	<0.01	<0.01	<0.01	<0.01
Lead	Pb	0.05	E1	<0.01	<0.01	<0.01	<0.01	<0.01
Mercury	Hg	0.002	E1	<0.001	<0.001	<0.001	<0.001	<0.001
Nitrate (NO_3) as	N	10.0	E1	0.05	0.27	<0.01	0.02	0.01
Selenium	Se	0.01	E1	<0.01	<0.01	<0.01	<0.01	<0.01
Silver	Ag	0.05	E1	<0.01	<0.01	<0.01	<0.01	<0.01
Fluoride	F	1.8	E1	1.5	1.3	0.7	0.2	0.7
Other Properties (mg/l except as otherwise noted)								
pH		6.5 - 8.5	E2	7.6 [2]	7.7 [2]	7.9 [2]	4.15 [2]	6.4 [2]
Total Dissolved Solids (TDS) at 180° C		500	E2	252	284	300	24	72
Specific Conductance (micromhos/cm)				430	430	500	75	134
Total Alkalinity as $CaCO_3$				220	160	138	10	62
Total Hardness as $CaCO_3$				209	212	216	12	70
Turbidity (NTU)		1	E2	0.24	2.7	1.5	0.3	4.8
Color (PCU)		15	E2	2	5	5	5	5
Foaming Agents		0.5	E2	0.22	<0.01	<0.01	<0.01	<0.01
Odor (units)		3	E2	10	2	3	10	5
Organic (mg/l)								
Endrin		0.0002	E1	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Lindane		0.004	E1	<0.001	<0.001	<0.001	<0.001	<0.001
Methoxychlor		0.1	E1	<0.05	<0.05	<0.05	<0.05	<0.05
Toxaphene		0.005	E1	<0.001	<0.001	<0.001	<0.001	<0.001
Total Pesticide				None Detected	None Detected	None Detected	None Detected	None Detected
2-4D		0.1	E1	<0.05	<0.05	<0.05	<0.05	<0.05
2,4,5-TP		0.01	E1	<0.005	<0.005	<0.005	<0.005	<0.005
Total Organic Carbon (TOC)				1.80	1.75	1.13	5.35	1.68
Oil and Grease				<0.1	<0.1	<0.1	<0.1	<0.1
Biological (colonies/100 ml)								
Total Coliform		4	E1	10	<1	<1	<1	<1
Fecal Coliform				8	<1	<1	<1	<1
Fecal Streptococci				48	<1	<1	<1	<1
Radionuclides (picocuries/liter)								
Gross Alpha		15	E1	27.6±0.8	0.0±0.3	4.6±0.4	9.9±1.2	4.3±0.6
Radium 226 plus Radium 228		5	E1					
Gross Beta		50	E1	0.0±2.0	3.9±1.8	0.0±1.8	12.1±3.5	7.8±2.4
Tritium		20,000	E1	357.7±5.4	301.7±5.4	84.6±5.3	338.5±5.4	450.1±5.4
Strontium 90		8	E1	<0.1	<0.1	<0.2	<0.2	<0.1

FOOTNOTES:

[1] W - World Health Organization, International (1963)
P - U. S. Public Health Service (1962)
C - California State Water Quality Control Board
E1 - Environmental Protection Agency Primary Standards (Mandatory)
E2 - Environmental Protection Agency Secondary Standards (Recommended)

[2] Field measurement

Table 4.8-B Ground-Water Analysis Results - Existing Wells

	APRIL 1974				
ANALYSIS	C 2449	H 2454	I 2455	J 2456	K 2457
Total Nitrogen, mg/liter	0.29	6.60	0.36	0.48	0.29
Nitrogen as Ammonia, mg N/l	0.10	0.15	0.25	0.35	0.20
Organic Nitrogen	0.15	1.45	<0.05	<0.05	<0.05
Nitrate Nitrogen, mg N/l	0.03	5.00	0.05	0.07	0.03
Nitrite Nitrogen, mg N/l	0.005	0.0023	<0.001	<0.001	0.003
Total Phosphates as PO_4mg/l	0.03	0.05	0.01	<0.005	<0.005
Diss. Ortho Phos., PO_4 mg/l	0.02	0.005	<0.005	<0.005	0.01
Total Residue, mg/l	25	330	380	228	258
Non-Filterable Res., mg/l	4	4	3	7	5
Potassium, as K mg/l	0.2	15.0†	0.80	1.0	0.6
Iron as Fe mg/l	0.20	0.09	0.48	0.36	0.19
Zinc as Zn mg/l	0.075	0.045	1.520	0.025	0.205
Copper as Cu mg/l	0.03	<0.01	0.05	0.10	0.05
Lead as Pb mg/l	0.041	<0.002	<0.002	0.139	0.005
Sulfides as H_2S, mg/l	<0.1	<0.1	<0.1	<0.1	<0.1
Dissolved Oxygen, mg/l	5.2	7.4	6.9	4.9	5.8
BOD, mg/l	1.7	<0.1	0.7	1.2	1.3
COD, mg/l	11	15	15	22	15
pH Laboratory	4.85	4.80	7.90	8.20	8.20
Total Coliform Colonies /100ml	TNTC	TNTC	TNTC	TNTC	TNTC
Fecal Coliform Colonies/100 ml	<1.0	<1.0	<1.0	<1.0	<1.0
Fecal Streptococcii, Colonies/ 100 ml (1)	<1.0	<1.0	<1.0	<1.0	<1.0
Chlorides, Cl mg/l	9.5	40.0+	9.0	14.5	8.5
Fluorides, Fl mg/l	<0.2	<0.2	<0.2	3.0	1.0
Silica, SiO_2 mg/l	2.5	2.4	9.9	2.7	3.0
Sulfates, SO_4 mg/l	<0.1	12.8	0.2	0.2	<0.1
Arsenic As, mg/l	<0.02	<0.02	<0.02	<0.02	<0.02
Oil and Grease, mg/l	<0.5	<0.5	<0.5	<0.5	<0.5
Surfactants (Methylene Blue Active Substances)	<0.01	<0.01	<0.01	<0.01	<0.01
Specific Conductance, mhos x 10^{-5} at 25° C	15	170	160	180	143
Pesticides	ND	ND	ND	ND	ND
Herbicides	ND	ND	ND	ND	ND
Turbidity, JCU	**	**	**	**	**
Color, Taylor Units	**	**	**	**	**
Temperature, Water °C	22.5	20.0	25.5	27.0	26.0

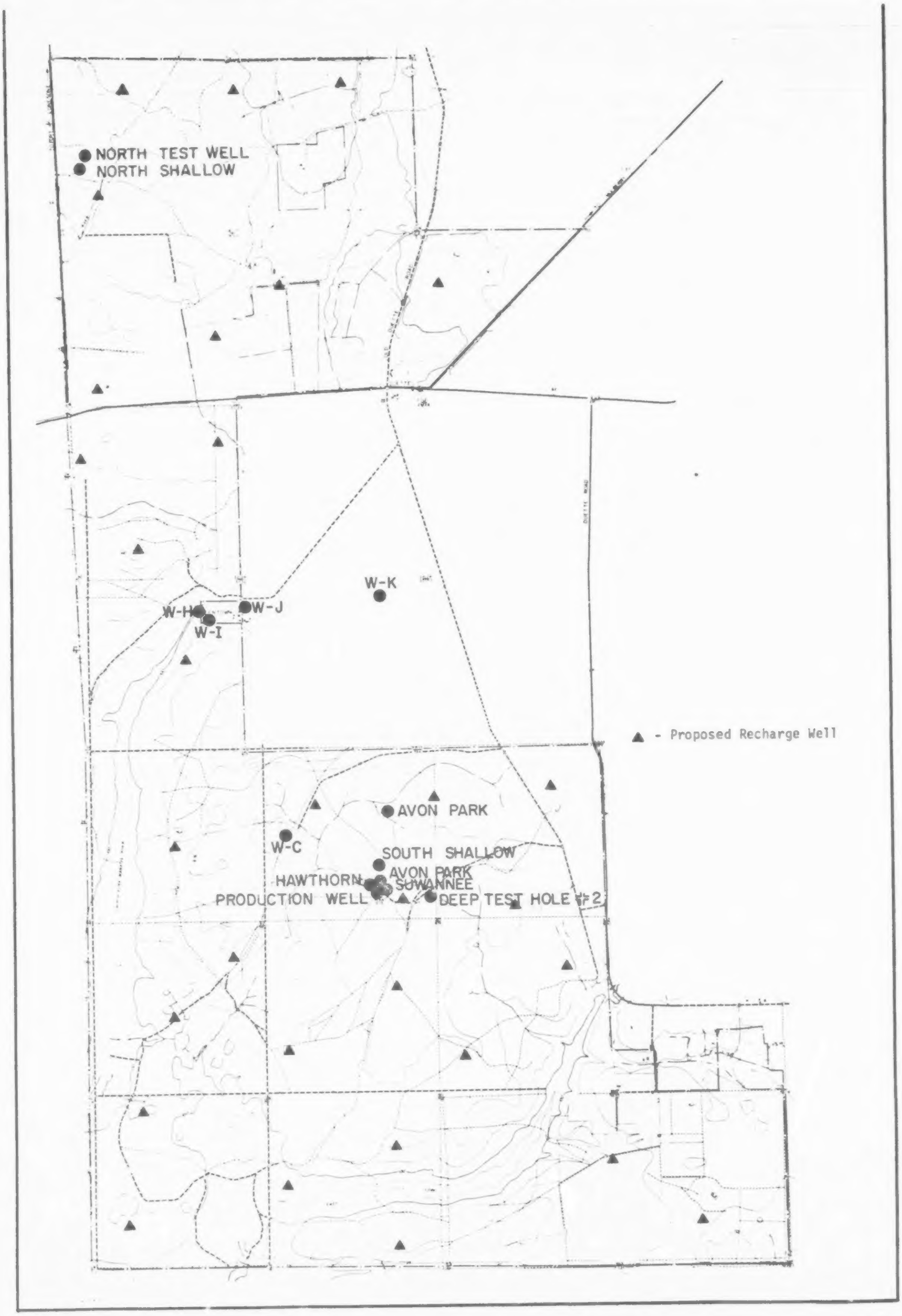

FIGURE 4.8-1

WELL LOCATIONS

SOURCE LEGGETTE, BRASHEARS & GRAHAM, INC

U S EPA – REGION IV
DRAFT ENVIRONMENTAL
IMPACT STATEMENT FOR
SWIFT AGRICULTURAL CHEMICALS
CORPORATION
PROPOSED DUETTE MINE
MANATEE COUNTY, FLORIDA

the producing horizons of the Hawthorn, Suwannee, and Avon Park Formations and less comprehensive chemical analyses for the Lake City Formation. Table 4.8-A contains the results of the analyses for samples collected above the Lake City formation.

The formations above the Lake City contain potable waters and the comparison of these to the mandatory or recommended drinking water standards are shown in Table 4.8-A. As evidenced by this table, the water withdrawn from the deep ground-water system meets the standards except for the hydrogen sulfide, odor, total coliform colonies and gross alpha determinations in the Hawthorn Formation. Additionally, the hydrogen sulfide and turbidity standards are not met in water from either the Suwannee or Avon Park Formations.

The Lake City Formation does not contain any appreciable producing zone due to the existence of interstitial and layered evaporites. Water from this formation (1740-2000 feet below land surface) is highly mineralized and does not meet most drinking-water standards. Sampling locations used for determining the general ground-water quality in the deep ground-water system were not located throughout the property but rather in the south and north portions. Figure 4.8-1 shows the well locations.

Impact

In general, the available data indicate that the shallow system contains water which is soft, high in iron and bacteria content and low in pH. The deep system contains water which, except for a few instances, meets the mandatory or recommended drinking water standards.

Effects will be noticed in the shallow ground-water system in response to the recharge and reclamation projects. Effects due to mining operations and dewatering are expected to be small in comparison.

The deep ground-water system will be effected primarily by the recharge project. Any effects on this system due to withdrawals and the subsequent water-level changes are anticipated to be negligible.

Shallow Ground-Water Quality - The dewatering of the surficial system for the purpose of mining is not expected to cause any adverse change in the quality of the water remaining in the system. Some minor changes will occur due to the additional capture of precipitation within the dewatered sands. Likewise, other than changes associated with additional capture of rainfall, the recharge project will not cause any change in the water quality. Although the dewatering and recharge projects will result in an increase in the amount of precipitation that is captured by the shallow ground-water system, the gradient in the system will convey this water to either the dewatering system or the recharge wells and thence out of the water-table system.

The use of the mined-out pits as storage areas for the waste clays and tailing sands will have an effect on the water quality in the shallow system. The nature of the water quality changes will depend on the nature of the material placed in the pits. The amount and kinds of reliable data needed to characterize the water quality of the waste clays are not available at the Duette Mine site due to the fact that the mine is not in operation. However, the clay-storage area (less than 5% of the property) is not expected to contribute a significant volume of water to the surficial aquifer system due to its size and the low-permeability range of the waste clays (.09 to .0007 gpd/ft^2). Therefore, changes in the water-quality within the surficial aquifer as a result of the clay-storage area should be restricted to its immediate vicinity.

If, following mining operations, a pit is filled with tailing sands, the water quality of the shallow ground-water system is expected to remain relatively unchanged. This is due to the nature of the tailings sands. Being predominately silica sands, the silica content may increase slightly, however, due to the low dissolution capability of silica, the increase should be very small. The tailings sands are more permeable than either the waste clays or the existing surface soils and, therefore, precipitation infiltration will increase. This should decrease the already-low hardness of the water in this system near the tailings impoundments.

In the majority of the reclaimed lands, the fill material is to be a mixture of tailings sand and waste clays in an approximate 2.5:1 ratio. This ratio is designed to reduce the permeability of the tailings sands and add nutrients to the mined-out areas that tailings alone cannot do. Reliable site-specific data regarding the chemical character of the water within the sand/clay mix have not been developed at the Duette Mine site. One sample collected from the pilot-plant study at the Duette Mine and data from water decanted from a pond which received sand tailings and waste clays at Swift's Silver City Mine, however, may provide some insight as to the quality of the water within the sand/clay mix at the Duette site. Comparison of water-quality data from the North and South shallow wells, with those from the previously mentioned studies indicate that differences between the quality of the water within the sand/clay mix and that within the surficial deposits may be seen as increases in chloride, ortho phosphate, nitrate, fluoride, pH, total dissolved solids, specific conductance and total alkalinity.

Once the mine begins operation and reliable site-specific data are available, the actual differences between the water quality of the various waste products and the surficial deposits can be refined and quantitative predictions may be made as to the effect of the placement of these waste products at the Duette Mine.

Although it is not anticipated to be a problem, the potential for leakage from slurry pipelines, return-water systems and other transport systems could have an impact on the water quality in the shallow ground-water system.

Deep Ground-Water Quality - With the exception of water in the Hawthorn Formation, water in the deep system meets the mandatory drinking water standards and most recommended standards down to the evaporite zones of the Lake City Formation. The effect of the proposed action on the water quality of this system will be due to both the withdrawal of water from the system and the recharge of water from the upper water-table system.

The potential effects due to the withdrawal of water from the deep ground-water system include the upconing of highly-mineralized water found below the producing zones and the lateral movement of salt water inland from the coast. It is extremely unlikely that either of these potential impacts will occur at the Swift site.

Upconing of the mineralized water located in the Lake City Formation requires a driving head and sufficient formational permeability to force these higher density waters into overlying formations. At the Swift site there is a substantial upward head drive from the Lake City to the Avon Park and Suwannee Formations, however, testing of the deeper formations has proved the permeability of the Lake City Formation is extremely low in comparison to the permeabilities of the overlying formations.

Estimates of the quantity of highly mineralized water being withdrawn during testing on the property of a well open into the evaporite zones indicated little movement of the deeper waters.

Data illustrating the integrity of the Lake City Formation was presented in Figure 4.7-2. This figure shows that the head in the Lake City Formation did not change during the period of record. Over this same period of time, heads in the overlying Avon Park and Suwannee Formations exhibit seasonal fluctuations of about 30 feet.

Calculations of the effect of withdrawals from the deep ground water system on the inland movement of the salt-water/fresh-water interface located near the coast are too complex to be done with much accuracy. In an attempt to determine the maximum effect on the potential for lateral movement, the use of a volume displacement model was employed. In essence, this model discounts recharge to the ground-water system as well as under flow in the system. The total volume withdrawn from the system is assumed to be supplied from the perimeter of a circular area with its center at the point of withdrawal and its initial radius at the existing interface. Calculations done with this model place the maximum inland movement of the perimeter at 169 feet for the 31 years of the mine operation. This movement is essentially immeasurable with present knowledge as to the exact location of the interface and existing technology. Applying this same model to the annual average volume of water presently permitted within the area coastward of the mine yields a maximum movement of the perimeter of about 102 feet per year.

As previously discussed, the SWFWMD consumptive-use permit requires the artificial recharge of an additional 3 mgd over the naturally-occurring leakage at the project site. The source of the additional recharge is the water-table, or surficial aquifer. Section 4.7 discusses the quantitative aspects of this requirement and indicates the calculated average recharge rate per well is about 70 gpm. At this calculated rate, 31 wells would be required and if possible, the induced recharge may include water from the matrix. The water-quality aspects of the recharge program are very complex and variable.

A complicating factor in the prediction of effects resulting from the recharge project is the reclamation project. Proposed reclamation measures include the placement of a mixture of waste clays and tailing sands in some of the mined-out pits. The reclamation project also proposes the placement of un-mixed tailings sands and waste clays in other areas. Reclamation of these mined-out areas by this method will have some effect on both the quantity and the quality of the recharged water. Although reliable site-specific data regarding the quality of the water derived from areas of sand/clay mix are not available for the Duette site, information is available from Swift's Silver City Mine. This information indicates that the water from a sand/clay mix at the Duette site may be expected to meet drinking-water standards except for fluoride, total dissolved solids and turbidity.

Mitigating Measures

In general, the major effect in the shallow ground-water system results from the reclamation project; with secondary effects being caused by waste-clay storage and the active mining operations. The deep ground-water system is effected primarily by the recharge/dewatering projects which directly transmit water from the shallow system to the deep system by means of wells. Mitigative measures for the deep ground-water system are included in the consumptive-use permit granted by the SWFWMD.

Shallow Ground-Water Quality - The primary effects anticipated within the shallow ground-water system are the water-quality changes associated with the reclamation project. Secondary effects include the temporal changes in quality resulting from the active mining operations and some changes due to the capture of additional rainfall within the dewatered sands surrounding dewatering/recharge wells.

Mitigative measures for the temporal effects may include monitoring the quality of the water being removed from the system by the dewatering/recharge wells and field inspection of the return ditches and slurrying pits. The monitoring of water levels in the system will give some indication of the existence of mounding near the ditches and pits which may be indicative of leakage. Mitigative measures for the potential changes due to the reclamation project are difficult to devise since the changes may be of such a nature that their effect on the environment may not be evidenced for a long period of time.

Deep Ground-Water Quality - The primary actions resulting in water-quality effects in the deep ground-water system include the dewatering/recharge projects from the system and the withdrawal of supply water from the system. The proposed actions may result in a lowering of the water quality in the deep system.

The dewatering/recharge projects will connect the shallow and deep systems allowing water in the upper aquifer to flow into the underlying Floridan Aquifer. Monitoring of the quality of the water being discharged from the shallow aquifer is required by the SWFWMD consumptive-use permit in paragraph 10 j for various parameters and at a specified schedule. This paragraph further provides for the cessation of the introduction of the water from the upper system for cause.

The permit also addresses the potential for upconing and requires analyses for various parameters or specific schedules for water from the production wells in the Floridan Aquifer.

As previously mentioned, the permit does not indicate the expected life of the recharge project. While the mine is actively operating, the recharged water will enter the area effected by withdrawals from the supply wells (cone of depression). About 60-70% will be captured in the flow pattern to the supply wells. The remaining water will enter the regional flow system of the Floridan Aquifer.

Due to the location of the proposed recharge wells and the slow movement of water within the regional system (about 60 feet/year), recharged water from only 2 of the 31 proposed recharge wells is expected to exit the property during the mine operation. At the end of the 21-year life of the project, about 98% of the total recharged water will remain beneath the mine property. When mining ceases, the cone of depression will cease to exist and all of the recharged water will begin to follow the regional flow pattern. Due to dispersion and dilution, the recharged water may become indistinguishable from the natural waters at the distance of a few miles or less from the property. The extremely low flow rate in the regional system and the large dilution factor within the Floridan Aquifer will strengthen the resource protection already afforded by the District permit.

A determination of the life of the recharge project and the possibility of the need for off-site monitoring of the deep system are closely tied. If recharge continues, the change in water quality down-gradient from the site should be monitored. If recharge ceases after the reclamation project, off-site monitoring may not be needed.

4.9 SURFACE WATER HYDROLOGY

Baseline

The distribution and circulation of water in the atmosphere, on the land surface, and in the soil and underlying rocks of the Duette Mine Site are typical of the Middle Gulf Hydrologic System as described by Cherry et.al. (1970). This well established hydrologic pattern is a result of the semi-tropical climatological regime, the very flat relief, the unconsolidated quartz sand surficial deposits, and the limestone and dolomite geologic formations of the region. It is characterized by an average annual rainfall of about 55 inches (SWFWMD), an average annual evapotranspiration of 39 inches, an average annual total surface runoff of 15 inches and an annual aquifer recharge of between 1/2 and 5 inches.

The 10,394 acre Swift site lies within portions of the watersheds of the Manatee River, the Little Manatee River, and the Myakka River. Less than 2.5% of the property, the southeast corner, drains southward to Wingate Creek, which is a tributary of the Myakka River. An area on the northwest corner, approximately 13% of the total site, drains to the west into the South Fork of the Little Manatee River which originates on the site. The major portion of the property, the remaining 85%, drains either into the North Fork of the Manatee River or the East Fork of the Manatee River. The North Fork of the Manatee River enters the site in the north, exits, re-enters north of the Keentown and re-exits in the southwest, draining about 39% of the site. The East Fork of the Manatee River enters in the southeast and exits across th southwest boundary, draining approximately 46% of the site. The north and east forks of the Manatee River come together approximately 4 miles southwest of the site, and drain into Lake Manatee about 10 miles downstream of the mine property. The Manatee River and Little Manatee River ultimately drain into Tampa Bay while the Myakka discharges into Charlotte Harbor. A comparison of the three watersheds which lie within the site boundaries is presented in Table 4.9-A.

Table 4.9-A Drainage Basin Areas

Watershed Name	Total Area of Watershed (sq. mi)	Area of Watershed Within Mining Site (sq. mi)	% of Watershed Within Mining Site (percent)	Area of Watershed Upstream of Mine Site (sq. mi)
Little Manatee River	211	2.2	1.0	3.7
Lk. Manatee	123	13.6	11.1	20.2
Myakka R.	550	0	0.1	0

Stream flow characteristics in the Central Florida region are a result of the relatively flat topography, with an average southwestward sloping gradient of 5 feet/mile and the subtropical rainfall. Stream bed channel slopes range from 0.5% to about 0.2% resulting in velocities of less than 2.5 feet per second. Approximately 60% of the total annual average precipitation results from thunderstorms during the 4 months of June, July, August, and September. These intense storms of relatively short duration saturate the surface soils, raise the water table to the land surface at many places, rapidly increase stream discharges, and occasionally cause some local flooding. The rains during the remainder of the year are generally widely spaced with respect to time of occurrence and are of the gentle frontal type. During this period stream flows decrease, the water table declines 6-8 feet, and some streams go completely dry, while much of the flow in the others is base flow that drains from the unconfined aquifer. The amount of base flow ranges from 14-20% of the total yearly runoff. Runoff from the mine site averages 14.7 inches per year from an annual rainfall of 54.6 inches, thus contributing an average of 11.8 million gallons of water per day to streamflow. About 13% of this amount, or 1.5 mgd drains to the Little Manatee River and about 85%, or approximately 10 mgd, drains to the North and East Forks of the Manatee River.

United States Geological Survey (USGS) stream flow records on the Manatee River, two miles downstream from the confluence of the North and East Forks, were analyzed to obtain average maximum, average mean, and average minimum monthly flows for the period of record from April 1966, through September 1974. Average monthly extreme flows at the downstream end of the Swift property were determined by assuming that the flow is proportional to the drainage area raised to the power 0.75, a regional relationship developed from historical records from nine USGS gauging stations in connection with flood plain studies. The results are shown on Figure 4.9-1. The East Fork of the Manatee River, during this 8 year period, had an average maximum flow of 242 mgd, an average mean flow of 43 mgd and an average minimum flow of 5 mgd for the wet August months. Correspondingly, the values for the usually dry April months were an average maximum flow of 19 mgd, an average mean flow of 3 mgd, and an average minimum flow of 0.8 mgd. Similar variations in flow were registered for the North Fork of the Manatee River and the South Fork of the Little Manatee River. Although this relatively short period of record could incorporate statistical sampling errors, the results show clearly the general trends, magnitude and variability of flow. Further analysis of the data indicates flows equal to or less than the average annual flow are expected 80% of the time. Hence, the discharges, like precipitation, are not evenly distributed over the year, but have large daily and monthly flow variations.

Flood plain studies of the stream within the mine site were conducted by Ardaman & Associates (1977). All of the stations are within basins that are hydrologically similar to the portions of the 3 basins within the mine site area. They have similar basin shapes, soil cover conditions, vegetation types, meteorological conditions, stream slopes and storage ratios (lake and swamp area to overall watershed area). Two of the selected watersheds are on the Manatee River, three are on the Little Manatee River, two on the Alafia River, and one each on the Myakka River and Horse Creek.

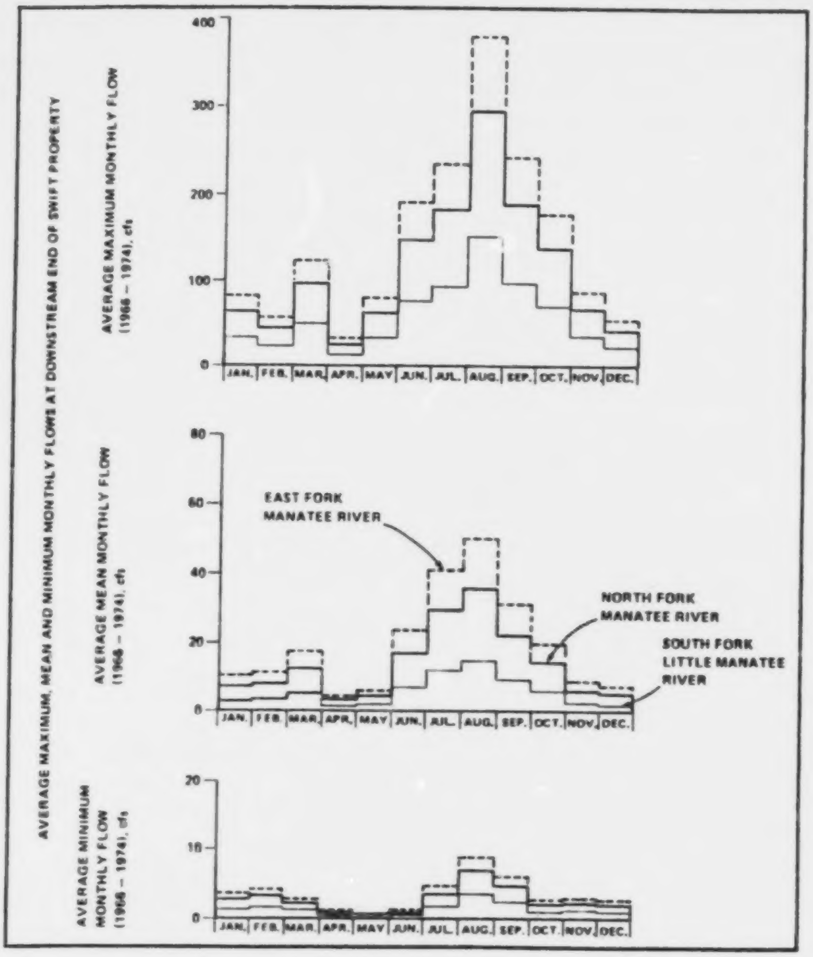

Figure 4.9-1 Average Monthly Flows

The Log Pearson Type III Method of flood frequency analysis, as described by the U.S. Water Resources Council Hydrology Committee, was performed on the records collected at each of the 9 gauging stations. This procedure provided data for plots of annual peak discharge versus recurrence interval of floods for each station. With this information and use of the following empirical relationship between drainage area and discharge:

$Q_T = C_T A^m$ where

Q_T = the estimate of peak discharges in cfs, for recurrence interval, T

C_T = empirical coefficient which varies with T and m

A = drainage area in square miles,

data for generalized plots of log Q versus log A for various desired recurrence intervals were developed. These relationships were used in conjunction with measured cross sections, slopes, and estimated channel roughness to obtain mean annual, 25 and 100 year flood elevations for the streams on the Swift property. The total inundated area for all streams within the site is 545 acres for the mean annual flood, 870 acres for the 25 year flood, and 1,120 acres for the 100 year flood. These are approximate 5, 8, and 11 percent respectively of the total Duette site area.

The peak discharge for floods of varying recurrence intervals of entry and exit points from Swift's property are presented in Figure 4.9-2.

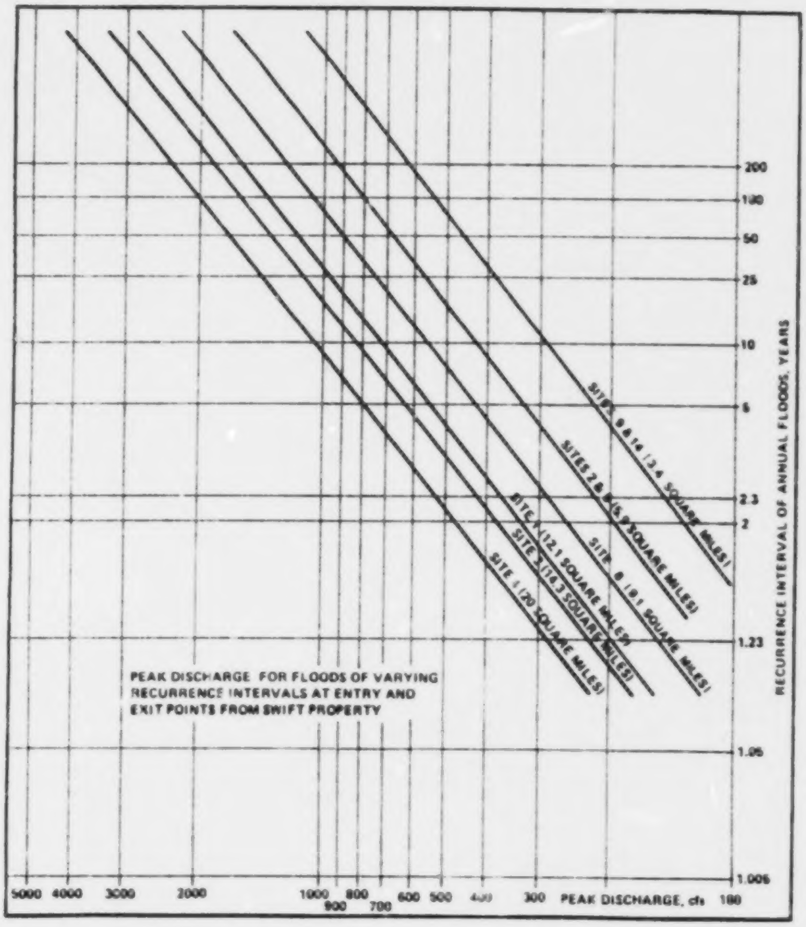

Figure 4.9-2 Peak Discharge for Floods of Varying Recurrence Intervals at Entry and Exit Points

Impact

In order to explain the effects of the Duette mine and plant on the regional water regime, it is necessary to review the water management plan. This plan was designed to minimize the use of well water. Water for the mining areas used to slurry and transport the matrix will be provided from a 200 acre surface water reservoir and a recirculating system. The reservoir will be filled during times of high flow from the East Fork Manatee River. In addition, runoff from active mining areas, roadways, and the beneficiation plant area will be collected in drainage ditches and added to the recirculation system. Water from wells will be used to provide make-up water in the flotation process only. The recirculation system water supply capacity will be relatively small during start-up and the early years of operation, requiring make-up water at a higher rate until the surface water reservoir and clay impoundment reservoirs are developed. It is anticipated that a minimum of three years of operation will be needed before a reasonable storage exists sufficient to satisfy normal rainfall, evaporation/transpiration variances and to nullify other losses in the system.

During peak stream flow periods a variable portion of the discharge of the East Fork Manatee River will be diverted through an off-channel weir to the surface water reservoir. This water which will be used to make-up 2.88 mgd of the process demands, amounts to 25% of the average annual runoff of 11.8 mgd which comes from the total Duette mine property. The diversion will not effect low or average flows since it will only occur during periods of high flow. The historical average maximum monthly flow of the East Fork Manatee River is 184 mgd for the three wet months of July, August, and September, while the average mean monthly flow for the same three month period is 26.5 mgd.

A general 1.6 mgd reduction in runoff from the Swift property will occur during the mining phase due to the increased area of water retention bodies on the property, i.e., mined-out pits and the initial settling area; a 2.6 mgd reduction will occur due to deep aquifer recharge resulting from the installation of connector wells; and a 0.1 mgd reduction in base flows due to dewatering of mine pits. These quantities, plus the 2.9 mgd diversion to the surface water reservoir, amount to a total reduction of stream flow of 7.2 mgd during the active mining phase. Approximately 1.8 mgd of the reduction will occur in the North Fork Manatee River, and 5.4 mgd in the East Fork Manatee River. Thus, the combined average flow of these two tributaries will be reduced from 22.1 mgd prior to mining, to 14.9 mgd during mining. This reduction in flow will decrease the discharge into the Manatee reservoir by approximately 9%.

Flow reductions for the Little Manatee River and the Myakka River will be significantly less and for a shorter duration (18 months) due to their smaller areas within the Duette property and due to the absence of water retention facilities or a process plant within those areas.

The majority of the water which enters the streams on the Swift property as base flow comes from ground water stored in the surficial aquifer within an approximately 2000 foot wide zone adjacent to the streams. Since mining is not planned within this zone, except for a three quarter mile segment of the East Fork Manatee River which will be rechanneled prior to its being mined, mining will have a minimal effect on base flow. It is estimated that the reduction in base flow resulting from mining will decrease the average flow of the East and North Forks Manatee River where they exit the property by 1.0% and 1.5% respectively.

The major drainage courses on the mine site will be left undisturbed by the mining operation, except for a small segment of the East Fork Manatee River. Reclamation will therefore deal primarily with the restoration of minor drainage conveyances which channel water into the major watercourses. Drainage divides will be created by the placement and contouring of tailings areas so as to re-establish the area of existing watersheds.

Analysis of daily rainfall records in conjunction with the U.S. Soil Conservation Service runoff curve numbers for the hydrologic soil-cover complexes on the Swift property prior to development and after reclamation indicates that runoff from the reclaimed property will be decreased by two to three inches per year. This decrease is the result of increased impoundments in lakes and marshes and the sand/clay mix land fills. After reclamation, the average flows of the East and North Forks Manatee River where they exit the Swift property will be reduced approximately 0.7 mgd and 0.6 mgd respectively to values of 12.2 mgd and 8.6 mgd. Although the amount of water detained on site during rainfall events will increase, peak flows will remain essentially unchanged.

Mitigating Measures

The reduction of surface runoff by construction and operation of mined out pits and other water retention structures will be mitigated by the reclamation of the mined lands to the topographical land forms which existed prior to mining. This reduction of runoff offers the benefit of reducing flood peak discharges.

With the exception of a small segment of the East Fork of the Manatee River, the major drainage courses of the mine site will be left undisturbed.

During peak stream flow periods a variable portion of the discharge of the East Fork Manatee River will be diverted through an off-channel weir to a surface water reservoir. The use of this surface water retention basin will result in a reduction of the ground-water requirement by 3 mgd.

4.10 SURFACE WATER QUALITY

Baseline

Introduction - The proposed Swift Duette Mine contains portions of three major river basins and four watersheds including the North and East Forks of the Manatee River, the South Fork of the Little Manatee River, and the Myakka River. Fairly extensive wetlands border the streams traversing the proposed site;

however, land uses at the mine site are primarily agricultural. Pollutant loadings of streams in the area arise almost exclusively from non-point, agricultural sources. There are presently no industrial or municipal point sources of water pollutants upstream or in the immediate vicinity of the proposed mine site.

Surface water quality is generally subject to daily as well as seasonal variation. It is closely related to stream discharge rates which are highly variable in streams on the site. Significant negative correlations of water quality parameters with flow occurs for alkalinity, sodium, sulfate, chloride, and fluoride; hence, as flow increases, the dissolved solids concentration decreases.

Because the great majority of proposed mine site lies within the Manatee River drainage basin, this water quality investigation (and others preceeding it) focused major attention on the North and East Forks of the Manatee River which converge and flow into Lake Manatee. Water quality of the South Fork Little Manatee River is examined in less detail since it drains a relatively smaller areas, and there will be no intentional interference with the stream by the proposed activity.

Lake Manatee is the primary potable water supply serving the majority of the population in Manatee County and a significant portion of Sarasota County (Tampa Bay Regional Planning Council (TBRPC), 1978. A study of water quality conditions in major reservoirs (including Lake Manatee) in the Tampa Bay region was conducted as part of the Areawide Water Quality Management (AWQM) Plan (TBRPC, 1978). That study concluded that water quality in Lake Manatee as of 1975 was good. Acceleration of the natural eutrophication by excessive nutrient loading was identified as the major problem threatening the reservoir's watershed. Runoff from pastures and fertilized cropland is recognized as the major source of these nutrients.

Data were collected from seven different private and governmental sources to assess the water quality baseline conditions and to provide a basis for assessing long-term trends in water quality. The map of surface water sampling stations (Figure 4.10-1) indicates locations where pertinent data were available and are included in the water quality data base.

A summary of the pertinent physical, chemical, and bacteriological parameters is given in Table 4.10-A. All values that do not conform to either State or Federal standards are italicized.

Table 4.10-A   Data Summary

PARAMETER		STATION NUMBER									
		1	2	3	4	5	6	7	8	9	10
Dissolved Oxygen*	Average	5.2	*4.7*	5.2	5.1	9.6	*3.5*	5.2	---	7.7	*3.7*
	Minimum	*3.4*	*2.3*	*3.5*	*4.2*	8.9	*0.4*	*2.9*	7.3	*4.6*	*0.7*
	Maximum	7.8	7.5	8.2	8.5	10.2	6.6	11.5	7.3	11.5	8.3
Turbidity (NTU)	Average	1.8	1.3	1.9	1.5	15.5	7.5	2.3	---	4.4	2.2
	Minimum	1.0	0.6	1.0	1.0	15.5	7.5	0.8		---	0.9
	Maximum	4.0	2.5	3.1	1.9	15.5	7.5	11.0		---	5.9
Total Suspended Solids	Average	7	12	7	7	*64*	19	5	---	15	15
	Minimum	2	1	2	3	*60*	2	0		0	8
	Maximum	18	*150*	*46*	*33*	*69*	*36*	21		27	29
Color (PCU)	Average	*122*	*230*	*153*	*126*	---	---	---	---	*143*	*131*
	Minimum	20	*100*	30	20	70	70			*80*	75
	Maximum	*250*	*360*	*225*	*230*	70	70			*280*	*200*
pH	Average	6.6	*6.3*	6.5	6.6	6.8	6.7	*6.2*	---	6.6	6.5
	Minimum	*6.0*	*5.5*	*6.0*	*6.4*	*6.3*	*6.3*	*5.7*	6.6	*6.2*	*6.0*
	Maximum	6.8	7.1	*7.1*	6.9	7.3	7.0	6.9	6.6	7.5	7.5
Fluoride	Average	0.41	0.43	0.31	0.37	0.35	0.35	0.34	---	0.21	0.45
	Minimum	0.27	0.26	0.18	0.21	0.20	0.20	0.17		0.15	0.13
	Maximum	0.66	*0.82*	0.44	0.58	0.50	0.50	0.54		*0.84*	*1.05*
Alkalinity, as $CaCO_3$	Average	38	21	36	45	---	---	---	---	*14*	---
	Minimum	*16*	*7*	*10*	*17*					*11*	
	Maximum	62	55	124	110					*17*	

* All units in miligrams per liter unless otherwise noted.

Italicized numbers indicate variations with State and/or Federal water quality standards.

Table 4.10-A (Continued)

PARAMETER		STATION NUMBER 1	2	3	4	5	6	7	8	9	10
Copper, as Cu	Average	*<0.13*	*<0.23*	*0.22*	*0.18*	<0.04	<0.03	---	---	<0.013	---
	Minimum	<0.01	<0.1	<0.01	<0.01	<0.02	<0.02		0	0	<0.02
	Maximum	*0.3*	*1.2*	*0.8*	*0.7*	*0.07*	*0.04*		0	*0.032*	<0.02
Iron, as Fe	Average	*1.2*	*1.7*	*1.7*	*1.6*	0.27	0.22	---	---	0.25	0.14
	Minimum	0.0	0.2	0.1	0.0	0.20	0.21		0.19	0.10	0.08
	Maximum	*4.2*	*3.6*	*7.6*	*8.4*	*0.34*	0.23		0.19	*0.45*	0.20
Zinc, as Zn	Average	<0.384	*0.08*	<0.018	*1.08*	0.018	*0.052*	---	---	0.03	---
	Minimum	<0.01	0.01	<0.005	*0.07*	0.005	0.013		0.03	0.01	*0.10*
	Maximum	*1.05*	*0.14*	0.03	*2.10*	0.030	*0.090*		0.03	*0.10*	*0.10*
Lead, as Pb	Average	<0.007	0.016	0.008	*0.222*	0.018	0.018	---	---	0.0156	.007
	Minimum	0.004	0.013	0.007	0.006	0.008	0.017		<0.01	0.005	.004
	Maximum	<0.01	0.020	0.009	*0.438*	0.028	0.018		<0.01	*0.039*	.010
Nitrogen, as N Total	Average	0.96	0.72	0.66	1.24	3.95	1.51	1.05	---	1.58	1.02
	Minimum	0.23	0.38	0.48	0.34	1.69	0.84	0.26	0.85	0.77	0.42
	Maximum	4.21	0.94	0.82	4.77	6.21	2.18	6.15	0.85	2.40	1.63
Phosphorus, as P Total	Average	*0.43*	*0.50*	*0.50*	*0.43*	*0.20*	*0.22*	*0.68*	---	*0.46*	*0.48*
	Minimum	*0.24*	*0.28*	*0.24*	*0.24*	*0.13*	*0.12*	*0.31*	*0.16*	*0.26*	*0.43*
	Maximum	*0.76*	*0.86*	*1.07*	*0.77*	*0.27*	*0.31*	*1.60*	*0.16*	*0.68*	*0.53*
Total Nitrogen/Total Phosphorus Ratio	Average	2.70	1.72	1.63	3.30	18.0	7.0	1.54	---	1.79	2.29
	Minimum	0.60	0.44	0.68	0.56	13.0	7.0	0.33	5.31	0.35	0.79
	Maximum	14.0	2.49	3.15	14.9	23.0	7.0	6.41	5.31	3.59	3.79
BOD (5-day)	Average	1.4	1.2	1.2	1.0	8.0	5.6	1.7	---	1.1	2.2
	Minimum	0.3	0.3	0.3	0.4	2.0	1.7	0.6	1.5	0.5	1.0
	Maximum	4.0	2.9	4.0	2.2	16	10	3.7	1.5	2.0	6.0

Italicized numbers indicate variations with State and/or Federal water quality standards.

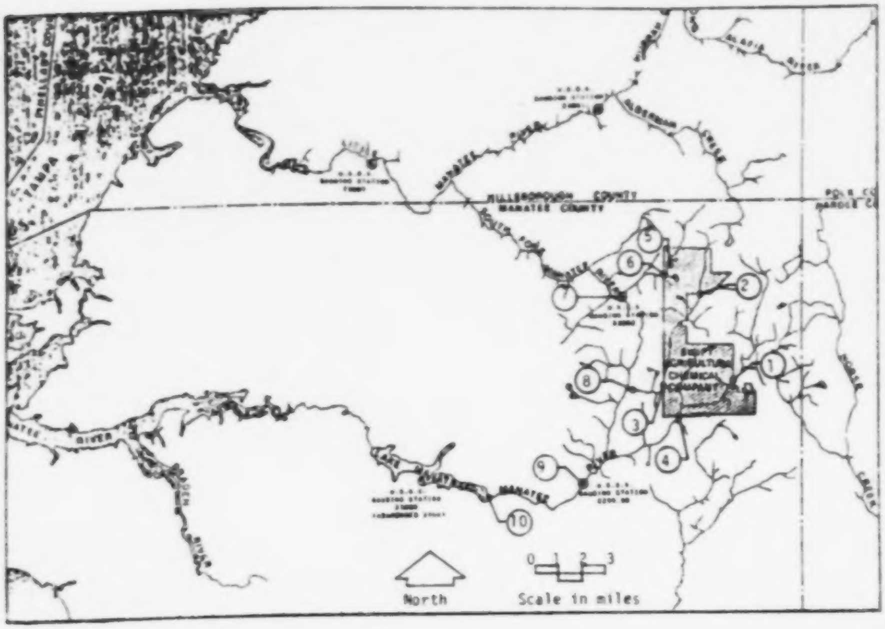

Figure 4.10-1 Surface Water Sampling Stations

Long-term and Seasonal Trends - Manatee County Health Department (Station 9) data were used to evaluate long-term water quality trends in the upper Manatee River basin.

Kendall's distribution-free test for independence (Hollander and Wolfe, 1973) was used to determine if significant time trends occurred in average annual concentrations of total dissolved solids, total suspended solids, turbidity, dissolved oxygen, biochemical oxygen demand, nitrate, ortho-phosphate, and fluoride. Only in the case of nitrate could a time trend (either increasing or decreasing) be established with 90% or greater certainty. The increasing trend of nitrate reflects the increasing influx of nitrogen to the Manatee River from agricultural sources.

Existing Water Quality - A key aspect of the water quality baseline was an evaluation of the conformance of existing water quality conditions with State of Florida and Federal criteria. The recently revised Chapter 17-3 of the Florida Administrative Code (F.A.C.) -- Water Quality Standards (effective March 1, 1979) contains three sets of surface water quality standards which are applicable to waters affected by the proposed project: (1) Section 17-3.061, General Criteria, (2) Section 17-3.091, Class I-A Waters - Potable Water Supplies, and (3) Section 17-3.121, Class III Waters - Recreation-Propagation, Management of Fish and Wildlife. Water quality data were also evaluated with respect to drinking water standards in F.A.C. Chapter 17-22, Water Supplies.

In addition to comparisons with State standards, variations with the following Federal water quality criteria and effluent limitations were examined. The Federal criteria are: (1) National Interim Primary Drinking Water Regulations (NIPDWR), 40 CFR 141, (2) U.S. EPA Quality Criteria for Water (1976), "Redbook". Like F.A.C. Chapter 17-22, the NIPDWR standards apply only to finished water -- not to raw water sources.

The frequencies with which measured parameters at each station vary with State and Federal water quality standards and effluent limitations were itemized. The more significant variations are summarized in the following discussion.

Upper Manatee River Basin: Fifty-six percent of the individual dissolved oxygen (D.O.) determinations at Stations 1 through 4 fell below the State and Federal stream standard of 5.0 mg/l. During a stream metabolism study (Biology and Ecology Resource Document), D.O. levels as low as 0.05 mg/l were measured. Average BOD_5 levels at the on-site stations ranged from 1.0 to 1.4 -- too low to explain the depressed levels of dissolved oxygen. The dependence of D.O. on water temperature and stream velocity (hence, reaeration) are the primary factors contributing to the seasonal variation in D.O. levels while the metabolism of stream organisms accounts for most of the diurnal variation.

The on-site data are contrasted by an average D.O. concentration of 7.7 mg/l measured by the Manatee County Health Department in Lake Manatee (Station 9), six miles downstream of the site.

Measured turbidity levels in the on-site were generally low. On the other hand, the mean organic color values exceeded the maximum recommended level (75 Platinum-Cobalt Units, PCU) for potable water supplies at all four stations. Complex organic compounds originating from decaying aquatic plants is the probable source of the color.

Corresponding to the low turbidity levels, total suspended solids (TSS) concentrations at stations on the North and East Forks are normally low. However, frequency analysis performed with the limited available data (Surface Water Quality Resource Document) indicated that TSS concentrations in the North Fork may be expected to exceed 60 mg/l 6% of the time. Further, 12.5% of the measured TSS concentrations (3 of 24) exceeded 30 mg/l while the frequency analysis predicted that 17% may be expected exceed that level. The results of a similar analysis performed with TSS data from Stations 1 and 4 on the East Fork indicated that the 30 mg/l levels will on the average be exceeded less frequently in the East Fork - 1.4% of the time - than in the North Fork.

The analyses support the observation that elevated TSS levels comparable in magnitude to federal effluent limitations applicable to phosphate mining operations occur with some frequency in surface waters on the proposed site.

Water in the North and East Forks is low in dissolved solids and characteristically soft as evidenced by the average total hardness range of 41 to 65 mg/l at on-site stations. Variations with the State's standard for alkalinity (20 mg/l minimum) were measured frequenty in the North Fork (8 of 20 determinations were below 20 mg/l) and occasionally in the East Fork (2 of 17 below 20 mg/l). Because of its importance in buffering pH change, EPA (1976) recommends that alkalinity not be further reduced in waters whose natural alkalinity is below 20 mg/l.

Values of pH below the State's minimum standard for Class III waters (6.0) were measured only at Station 2 on the East Fork where 17% of the pH determinations were below 6.0. In spite of these variations, the observed pH values appear to reflect natural conditions in the East Fork. Comparable values have been measured in watersheds adjacent to the Manatee River basin (EPA, 1978).

Mean fluoride concentrations at Station 1 through 4 (0.30 to 0.40 mg/l) are typical of levels found in undisturbed streams in west central Florida (EPA, 1978), but are above the levels found in uncontaminated streams in other areas of Florida (Ardaman and Associations, 1978). Neither the State Class I-A (Public Water Supplies) nor NIPDWR standard for fluoride (1.5 and 1.4 mg/l, respectively) was exceeded by any of the measured concentrations. However, the fluoride standard of 0.8 mg/l in F.A.C., Chapter 17-22 (Water Supplies) was occasionally exceeded in measurements on and downstream of the site. In spite of these occasional variations in fluoride levels with the State's finished drinking water standard, fluoride levels in treated water delivered to Manatee County users have not been found to exceed 0.8 mg/l.

Average measured concentrations of total phosphorus as P at Stations 1 through 4 ranged from 0.43 to 0.50 mg/l, considerably above the 0.070 mg/l average of river waters worldwide (Hutchinson, 1975). These elevated levels are consistent with phosphorus concentrations generally found in central Florida streams (EPA, 1978). Dissolution of natural phosphate-bearing minerals and leachate and runoff from pastures and fertilized croplands are the most likely sources of phosphorus (Ardaman and Associates, 1978); however, the relative contribution from each source is not easily determined from available data. EPA (1976) recognizes a number of naturally occuring phenomenon which reduce the threat of phosphorus to lake eutrophication including situations where nutrients other than phosphorus limit plant growth.

Average total nitrogen concentration at the four on-site stations ranged from 0.66 mg/l to 1.24 mg/l. Measured concentrations in the East Fork were on the average noticeably greater than in the North Fork due primarily to occasionally elevated organic nitrogen components at the East Fork stations.

While ordinarily prime determinants of aquatic plant growth, nitrogen and phosphorus do not appear to limit primary productivity over most stream courses on the site. Light is evidently the factor limiting aquatic plant growth on the site due to the dense canopy of swamp forest overhanging the streams.

The few areas that lack the forest canopy support dense growths of benthic macrophytes. Nitrogen may become operationally significant as a limiting factor in these areas.

Average total nitrogen to total phosphorus ratios at stations in the upper Manatee River basin ranged from 1.63:1 on the East Fork to 3.30:1 on the North Fork. These N:P ratios are substantially lower than the 23:1 ratio characteristic of natural waters in general (Hutchinson, 1944), and more importantly, are below the 13:1 ratio (of organic nitrogen to total phosphorus) which EPA (1977) employs as the threshold for nitrogen limited aquatic systems. Because nitrogen is in relatively short supply compared to phosphorus, nitrogen is potentially the nutrient which limits primary productivity in the area's water except where productivity is limited by other factors (e.g., light).

The average N:P ratio at the head of Lake Manatee is comparable to those in tributary streams on the Duette Mine site and indicates that nitrogen functions as the limiting nutrient. Therefore, changes in nitrogen loading of the Lake potentially cause corresponding changes in primary productivity and, hence, eutrophication rates.

South Fork Little Manatee River: Physical water quality parameters in the South Fork Little Manatee River exhibit similar patterns to those in the North and East Forks Manatee River. Stream discharge rates are highly variable; however, the peak discharge at its exit from the Swift property is only a small fraction of discharge rates in North and East Forks. The water is highly colored, and like the North and East Forks, measured dissolved oxygen concentrations were below the 5.0 mg/l standard more often than not.

Four measurements of total suspended solids concentrations at Stations 5 and 6 on the site were available for the data base. However, the data suggest that elevated TSS levels are not uncommon in the segment of the South Fork on the site.

With the exception of pH none of the major cations and anions, including fluoride and alkalinity, varied with the state standards for Class III waters. Average pH at the on-site stations was slightly above the 6.0 minimum recommended by the State and EPA.

The average total nitrogen concentration at Station 7 (1.05 mg/l) agrees well with the values observed in the Manatee River basin. Also, the occasional spikes in nitrogen concentration (6.15 mg/l maximum) corresponds to large increases in the organic nitrogen fraction -- the same relationship exhibited in the Manatee River data. The average measured total phosphorus concentration in the South Prong watershed (0.68 mg/l) was somewhat above the average measured in the upper Manatee River basin.

Summary - Occasionally large and/or frequent variations with State and Federal water quality standards were observed in measured concentrations of numerous physical, chemical, and bacteriological parameters in both the upper Manatee and South

Fork Little Manatee River basins. For the most part, these variations appear to reflect natural conditions in these waters. Furthermore, the quality of the water has permitted the development and maintenance of moderately dense and diverse faunal communities in the streams (Biology and Ecology Resource Document). While the two river basins are noticeably dissimilar in terms of their periphyton and macroinvertebrate community structures, both systems are characterized by "clean" water conditions and are detrital based.

Impact

Composition of Discharges from Duette Mine - Discharges to streams leaving the proposed mine site from the plant water system are necessary at certain times of the year due to considerable temporal variation in the region's rainfall distribution (Swift Agricultural Chemicals Corporation, 1978, 1979). For 59 days during August and September of an average rainfall year, 1.959 million gallons per day (mgd) will be discharged from the mining, reclamation, and plant site in the southeast portion of the property. The discharge will be through point 002 into the East Fork of the Manatee River (Figure 4.10-2). Effluent will be discharged for 90 days during August, September, and October of the average rainfall year to the North Fork from the clay settling area through point 003 at a rate of 1.773 mgd.

The composition of effluents from both dicharge points will be similar to the effluent from Swift Agricultural Chemicals Corporation's Silver City mine. Since caustic soda and slaked lime will normally be used as neutralizing agents in the proposed facility in lieu of the ammonia used at Silver City, the ammonia and total nitrogen concentrations will be less than those observed in the Silver City effluent. For the purposes of this impact evaluation the ammonia concentration in the mine effluent may be assumed less than the background ammonia levels in the East Fork Manatee River (0.29 milligrams per liter) owing to dilutional effects of well water additions. It follows that related nitrogenous compounds would be similarly decreased.

Flotation reagents are used in dilute quantities (Swift Agricultural Chemicals Corporation, 1978) to separate phosphate rock from sand particles in the flotation circuits. These reagents are selected because of their property to preferentially adhere to phosphate or sand particles and achieve separation of the two materials. All reagents have preferential affinities for clay particles; hence, the flotation feed is carefully washed to remove all possible traces of clay. Flotation circuits in new plant designs seek to minimize reagent use to levels not appreciably exceeding the quantities that adhere to the product leaving the flotation circuit. Inasmuch as waters discharged from the flotation circuit join with waters containing clays from other plant operations, e.g., washing, further opportunity is provided for residual reagent to form physiochemical attachment to clay particles. Thus the concentrations of these substances are expected to be substantially less than reflected by the dilution ratios referenced above.

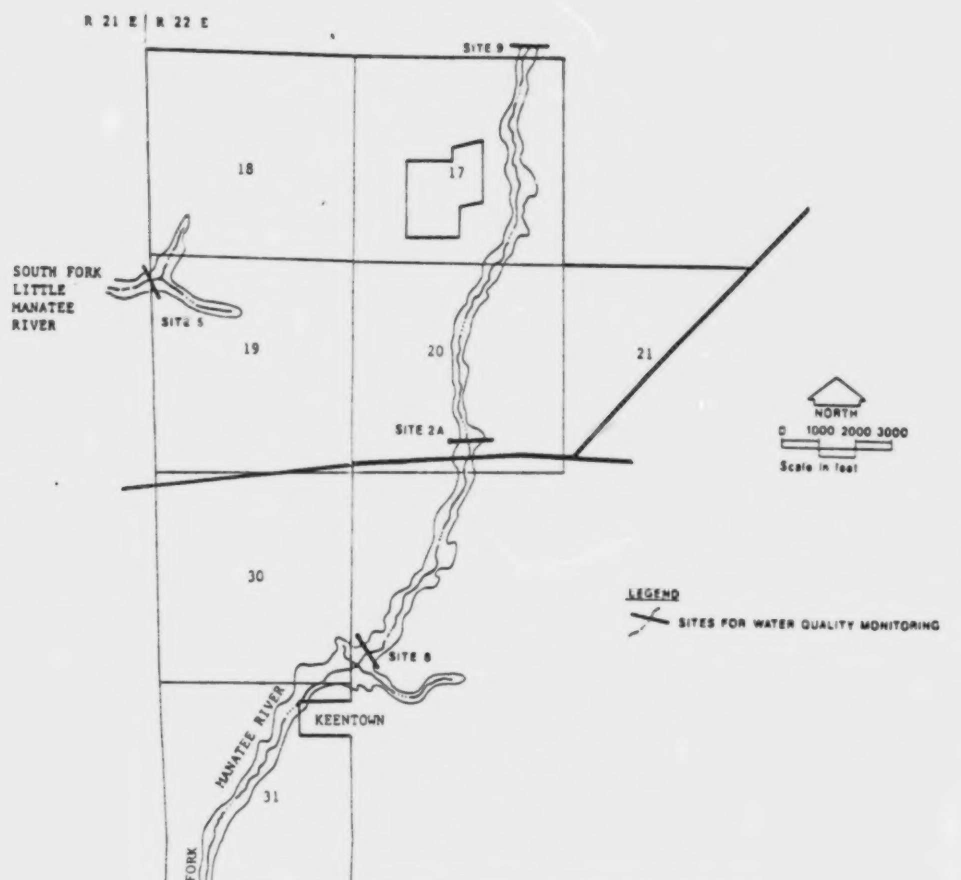

FIGURE : 4.10-2

DISCHARGE POINTS AND WATER QUALITY MONITORING STATIONS

SOURCE : ZELLARS - WILLIAMS , INC.

U.S. EPA - REGION IV
DRAFT ENVIRONMENTAL
IMPACT STATEMENT FOR
SWIFT AGRICULTURAL CHEMICALS
CORPORATION
PROPOSED DUETTE MINE
MANATEE COUNTY , FLORIDA

The chemicals used in the flotation process are fatty acids, fuel oil, sodium hydroxide, dilute sulfuric acid, straight-chain amines and kerosines. These chemicals will form relatively insoluble complexes, precipitates and/or exhibit non-refractory characteristics in the environment, i.e., chemically degrades to simple compounds or molecules.

Comparison of Discharges with Effluent Limitations and Guidelines - Of the numerous water quality parameters investigated in the impact analysis, the nine listed in Table 4.10-B will be regulated under conditions of the NPDES permit application for the proposed mine. Expected 30 day average and daily maximum concentrations are given in Table 4.10-B as they appear in the NPDES permit application (Surface Water Quality Resource Document , Appendix B). Historical discharge data from Swift's Silver City Mine, results of Silver City Mine comprehensive effluent analysis, and EPA's effluent guidelines applied to other mining operations in the area were taken into account in developing the expected discharge levels from the Duette Mine.

Table 4.10-B NPDES Permit Application Effluent Limitation

Parameter	Expected 30-Day Average	Expected Daily Maximum
pH	---	6.0-9.0
Temperature (winter), °F	55	---
Temperature (summer), °F	90	---
Biochemical Oxygen Demand (5-day), mg/l	2.9	---
Total Suspended Solids, mg/l	30	60
Specific Conductance, mhos/cm @ 25°C	---	500-1000 (min.- max.)
Copper, mg/l	0.01	---
Oil and Grease, mg/l	5	---
Total Phosphorus as P, mg/l	3.0	9.0

EPA has established limits for allowable 30-day average and daily maximum levels of total suspended solids (TSS) and total phosphorus, and recommended limits on total fluorides (5.0 mg/l 30-day average and 10.0 mg/l daily maximum) in the proposed mine effluent. The limitations are typical of permitted mines in the area, and represent concentrations which may be exceeded, albeit infrequently in the Duette Mine effluent. Results of long-term effluent monitoring at Swift's Silver City Mine, which is representative of the effluent from the proposed mine with regard to these parameters, suggest that EPA's guidelines for fluoride and TSS would rarely be exceeded during the life of the mine.

On the basis of Silver City Mine measurements, the expected 30-day average phosphorus concentration in the Duette Mine effluent may be expected to exceed the 3 mg/l effluent limitation at a frequency of about 14%. The daily maximum limitation of 9 mg/l may expectedly be exceeded at a frequency of approximately 5%.

The expected daily minimum pH of 6.0 is in accordance with EPA's effluent limitation guideline applicable to phosphate rock froth flotation operations in general (40 CFR 436.182). One of 61 measurements of pH in the Silver City Mine data exceeded 9.0 giving an expected frequency of exceedance of 1.6%.

The expected 30 day average and/or daily maximum levels of BOD, specific conductance, oil and grease, and copper were developed primarily from the August, 1978 comprehensive analysis of the Silver City Mine effluent (Surface Water Quality Resource Document) with tolerances added to allow for the expected variability in effluent composition.

Swift will regularly monitor effluent water quality at the permitted points of discharge to assure compliance with NPDES permit conditions.

Florida Department of Environmental Regulation effluent limitations for phosphate rock mining and processing (F.A.C. 17-6, effective October 1, 1977) are more stringent than the federal guidelines with respect to TSS and total phosphorus; however, the limitations of pH are identical. Whereas, the state's 30-day average phosphorus limitation of 3 mg/l is the same as the federal guideline, the allowable daily maximum of 5 mg/l is approximately one-half of the limit set by EPA for the proposed mine. The state's daily maximum limitation was exceeded in only two of sixty-one separate determinations of total phosphorus in the Silver City Mine effluent.

On the basis of the Silver City results the state's 30 day average TSS limitation of 12 mg/l and daily maximum limitation of 25 mg/l may be expected to be exceeded more frequently than the corresponding federal guidelines (Surface Water Quality Resource Document).

Comparison of Discharge Water Quality with Ambient Water Quality Standards - Constituents of the plant discharge which might potentially degrade the quality of the streams leaving the site were determined through a preliminary screening process. The approach compares the expected concentrations of constituents in the plant effluent with ambient state and federal water quality standards. The discharge of any constituent whose concentration in the effluent is expected to be below the ambient water quality standards cannot cause the standards to be exceeded in the receiving streams (regardless of the quantity of the discharge) and will not noticeably alter the water quality. All parameters investigated in the surface water quality baseline including physical parameters, natural ions, bacteriological characteristics, trace metals, nutrient composition, and organic substances were screened in this manner. The parameters were evaluated in relation to the following ambient water quality standards and criteria: (1) F.A.C. Chapters 17-3 and 17-22 (Water Quality Standards and Public Water Supplies, respectively); (2) U.S. EPA Quality Criteria for Water (EPA 440/9-76-023); (3) National Interim Primary Drinking Water Regulations

(40 CFR 141); and (4) The Central Florida Phosphate Industry Areawide Impact Assessment Program.

Of the forty-seven parameters investigated for which standards exist, fluoride and total dissolved solids (and the related parameter, specific conductance) are the only parameters whose concentration in the effluent may be expected to exceed ambient water quality standards within the limits of detectability of standard analytical techniques. These parameters, therefore, merited further investigation.

Predicted Mass Loadings and Concentration - In addition to fluoride and TDS the parameters, total phosphorus, total nitrogen, Biochemical Oxygen Demand (BOD), and total suspended solids (TSS) were selected for further evaluation because of their potential effects on downstream water supplies. The effects of each of the six parameters was evaluated by estimating mass loadings (lbs/day) and concentrations (mg/l) in both the North Fork and East Fork after complete mixing with the effluents from discharge points 003 and 002, respectively. Predictions were made for the average daily minimum and average daily maximum stream flow rates during the months of discharge. Average annual concentrations of parameters were typically used in the stream loading computations.

Mass loading of the above six parameters in the mine effluent were based on average discharge rates during a normal rainfall year. Loadings of total nitrogen, BOD, and TSS were computed for both 30-day average and daily maximum contaminant levels as given in Table 4.10-B.

The predicted total mass loadings and resultant parameter concentrations after mixing are summarized in Tables 4.10-C (East Fork) and 4.10-D (North Fork) and compared with the present conditions.

East Fork of Manatee River

Nutrients: The largest increase in total phosphorus loading and resultant stream concentration (0.43 to 4.2 mg/l) is expected to occur when the minimum stream flow mixes with effluent containing the maximum expected phosphorus concentration (Table 4.10-C). The elevated phosphorus levels is expected to have minimal effect on primary productivity rates in the upper Manatee River basin since naturally occuring phosphorus in the surface waters is relatively abundant in comparision with the other major nutrient, nitrogen. Hence, phosphorus is not expected to be operationally significant as a limiting factor as noted in the baseline discussion.

Biochemical Oxygen Demand: A 0.8 mg/l increase in BOD is estimated at minimum stream flow. This is approximately one standard deviation from the mean BOD_5 value measured just downstream of discharge point 002. Hence, under present stream conditions it is not uncommon for BOD_5 levels to exceed the level predicted with the new mine.

Table 4.10-C East Fork Manatee River, Mass Loadings and Concentrations after Mixing

	Minimum Flow				Maximum Flow			
	Mass Loadings lbs/day		Concentration mg/l		Mass Loadings lbs/day		Concentration mg/l	
Parameter	Present	With New Source	Present	With New Source	Present	With New Source	Present	With New Source
Total Nitrogen, as N	51.7	43.9	1.2	1.2	2,070	2,035	1.2	1.2
Total Phosphorus, as P:								
Average	17.9	58	0.43	1.6	717	748	0.43	0.46
Maximum		156		4.2		846		0.51
Fluoride, as F:								
Average	17.5	90.5	0.42	2.4	367	490	0.22	0.27
Maximum		172		4.6		521		0.32
Biochemical Oxygen Demand, 5-day	41.7	68.3	1.0	1.8	1,670	1,670	1.0	1.0
Total Suspended Solids:								
Average	292	636	7.0	17	11,700	11,870	7.0	7.2
Maximum		1,126		30		12,360		7.5
Total Dissolved Solids	6,170	13,200	148	355	128,600	135,500	77	82

Table 4.10-D North Fork Manatee River, Mass Loadings and Concentrations after Mixing

Parameter	Minimum Flow				Maximum Flow			
	Mass Loadings lbs/day		Concentration mg/l		Mass Loadings lbs/day		Concentration mg/l	
	Present	With New Source	Present	With New Source	Present	With New Source	Present	With New Source
Total Nitrogen, as N	17.6	24.0	0.66	0.91	732	737	0.66	0.66
Total Phosphorus, as P: Average Maximum	13.3	50.2 139	0.50	1.9 5.3	555	590 679	0.50	0.53 0.61
Fluoride, as F: Average Maximum	8.3	77.5 152	0.31	2.9 5.7	344	413 487	0.31	0.37 0.44
Biochemical Oxygen Demand, 5-day	32.0	56.9	1.2	2.1	1,330	1,350	1.2	1.2
Total Suspended Solids: Average Maximum	187	525 969	7.0	20 37	7,760	8,092 8,535	7.0	7.3 7.7
Total Dissolved Solids	3,360	10,600	126	402	139,800	147,000	126	132

Fluoride: Under conditions of average maximum daily stream flow the fluoride concentration in the East Fork was estimated to increase from the 0.22 mg/l background level to 0.27 mg/l at the average mine effluent loading and to 0.32 mg/l at the maximum effluent loading. Both resultant concentrations are well within the State's General Criteria for fluoride (10 mg/l) applicable to Class III fresh waters and meet, as well, state and federal criteria for drinking water supplies (1.5 and 1.4 mg/l, respectively).

At the average minimum daily stream flow during August and September, the fluoride concentration after mixing will remain within the state General Criteria for fluoride applicable at the point of mixing.

At the recommended maximum effluent fluoride level of 10 mg/l and minimum stream flow, a resultant fluoride level of 4.6 mg/l at the point of mixing could be expected - less than half of the applicable ambient water quality standard.

Taking into account the substantial dilution of the elevated fluoride concentration between the point of discharge and the head of the reservoir, the fluoride concentration at Station 10 was estimated at 1.7 mg/l, approximately 13% above the State's allowable of 1.5 mg/l for Class I-A waters (Surface Water Quality Resource Document). Some reduction in the estimated 1.7 mg/l concentration could be expected by runoff and base flows to the reservoir from the substantial area downstream of Station 10. The effect of this additional dilution would be to reduce the fluoride level at the Manatee County water plant intake to within the state's standard for public water supplies.

Total Suspended Solids: The difference in total suspended solids (TSS) concentrations with and without the new mine will be minimal at high stream flow. The background TSS frequency analysis (Surface Water Quality Resource Document) indicates that TSS levels in excess of 17 mg/l - the concentration resulting from the expected 30-day average effluent discharge - may be expected in the natural stream 8% of the time. The same analysis indicated that the predicted stream TSS concentration of 30 mg/l resulting from the maximum effluent TSS concentration of 60 mg/l will on the average be exceeded 1.4% of the time under natural stream conditions. The stream's present frequency of exposure to elevated TSS levels is not expected to be appreciably altered by the infrequent occurrence of the hypothesized worst case discharge conditions.

Total Dissolved Solids: At minimum stream flow, discharges from the mine will result in a 140% increase in TDS concentration. However, the maximum predicted concentration of 355 mg/l is within the 500 mg/l monthly average standard for Florida's Class I-A waters, i.e., potable water supply.

At the average maximum stream flow dissolved solids will increase by 6% over background levels.

North Fork of Manatee River - The minimum average flow of the

North Fork at point of discharge 003 is approximately 64% of the minimum flow in the East Fork at discharge point 002. Since the discharge composition and flow rates from the two points are nearly the same, the effect of the discharge on the water quality of the North Fork is expected to be somewhat greater than the effect on the East Fork. In spite of this difference, none of the State's water quality standards applicable to the North Fork -- a Class III water -- will be exceeded over the investigated range of stream flow conditions.

Nutrients: Under worst case conditions of minimum stream flow and maximum effluent concentration the estimated increase in the phosphorus level is 4.8 mg/l at the point of mixing. While the projected increase in phosphorus under this extreme condition is substantial, the predominant role of nitrogen as the growth limiting nutrient minimizes the impact of the phosphorus loading on the stream water quality.

At the maximum stream flow the estimated elevation in phosphorus concentration will be substantially less, increasing by 6% over background at the average effluent phosphorus concentration and 20% at the maximum concentration.

Biochemical Oxygen Demand: A 0.9 mg/l increase in the stream BOD_5 concentration is predicted for the minimum stream flow condition. The resultant concentration of 2.1 mg/l is well within the range of observed BOD_5 background level at Station 3 on the North Fork. Virtually no change in the BOD_5 concentration will occur at the maximum stream flow.

Fluoride: At minimum stream flow and average effluent fluoride loading the fluoride concentration is estimated to increase from 0.31 to 2.9 mg/l. At the maximum effluent fluoride loading, the concentration in the North Fork may be expected to increase to 5.7 mg/l at the point of mixing. Both resultant concentrations remain within the allowable 10 mg/l for Class III waters.

Total Suspended Solids: At the average minimum stream flow, TSS concentrations after mixing are estimated to range from 20 mg/l at the average effluent TSS loading up to 37 mg/l at the maximum discharge concentration. While the latter value is considerably greater than the average TSS concentration of 12 mg/l observed in the North Fork at its exit from the Swift property (Station 3, Figure 4.10-2), it is well within the range of 1 to 150 mg/l measured at Stations 2 and 3 on the North Fork. TSS levels in excess of 20 mg/l are expected to occur on the average about 23% of the time in the North Fork under natural conditions. Hence, the expected average TSS loadings from the mine will not result in abnormally high TSS levels in the river.

Total Dissolved Solids: A substantial increase in the TDS level is likely under minimum stream flow conditions. Nevertheless, the predicted resultant concentration of 402 mg/l is well below the 1000 mg/l maximum level allowed by the State's Class I-A (Public Water Supply) standard and satisfies the 500 mg/l monthly average criteria as well.

Hypothetical Failure of Clay Settling Area Embankment

Introduction: Evaluation of a hypothetical failure of the clay settling area embankment on the water quantity, quality, and biology of the receiving waters and adjacent wetlands is summarized below beginning with a description of the event and a brief discussion of its probability of occurrence.

The impact analysis was predicated on a ground-level break in the settling area embankment at the end of the third year of mining. At that time, the 480 acre settling area will be filled to capacity with approximately 23 feet of waste clays covered with 2 feet of clarified water. Two points of failure were considered separately - one in the west wall of the embankment in the vicinity of the steepest slope between the settling area and the streambed of the North Fork, and a second in the south wall at the point nearest the East Fork.

An estimate of the probability of the embankment failure (Ardaman and Associates, Inc., 1979) was based on the average value for annual risk of a modern dam failure (approximately 1 in 10,000) adjusted for hydrologic and structural conditions unique to the proposed settling area. The most common causes of dam failure - overtopping during large floods, subsurface erosion, earthslides, and earthquakes, in order of decreasing probability - are all less likely to occur to the proposed embankment than to an average modern dam for the following reasons: accurately predictable peak water levels; favorable soil and seismic conditions; uniform embankment and foundation section; and the rigorous design and inspection requirements of Chapter 17-9 of the Rules of the Florida Department of Environmental Regulation. Cumulatively, the above factors reduce the annual risk of failure to about one chance in 100,000 or one-tenth the probability of a clear water dam failure.

Water Quantity Impact: The primary concern with respect to water quantity impact is the potential reduction in safe reservoir yields of Lake Manatee and the proposed Beker reservoir. The safe yield of Lake Manatee before and after the hypothetical waste clay spill was evaluated for the present minimum reservoir operating level of 28 feet Mean Sea Level (MSL), and for the proposed minimum operating of 21 feet MSL (Ardaman and Associates, Inc., 1979). In its present condition, the safe reservoir yields for Lake Manatee at the 28 feet MSL and 21 feet MSL operating levels are 29.7 and 34.2 million gallons per day (mgd), respectively.

The reduction in safe yield was predicted for two levels of percent solids in the released clays - 18.2% and 23.6% - as measured in samples of thickened clay from pilot plant runs on matrix from the proposed site. Percentage reductions in safe yield of Lake Manatee due to the spill were estimated to range from 4-8% at the 21 feet operating level and 4-9% at the 28 feet level.

The impact of a hypothetical failure in the south wall of the embankment of the proposed Beker Reservoir on the East Fork, Manatee River was similarly evaluated using an initial solids content of 18.2%. The results indicated a probable reduction in safe reservoir yield of about 1%.

Further conclusions of the impact evaluation with respect to surface water hydrology are summarized below:

- Waste clay from the spill will be contained within the 100 year floodplain of the Manatee River.

- The increased water level in Lake Manatee after a hypothetical spill would be less than two feet and would pose no danger to the dam,intake structures, or spillway structure.

- Erosion of the clay waste by rainfall runoff during the two-month period after a spill while vegetation is being re-established, will result in increased suspended solids loadings of approximately 700 ppm. This amount will not cause any significant increase in sediment load within the reservoir.

Water Quality Impact: Evaluation of the impact of the hypothetical settling pond failure on stream and reservoir water quality was subdivided into six areas or phases of potential impacts: (1) effects on stream water quality, (2) short-term effects on the Lake Manatee Reservoir, (3) intermediate-term effects on the reservoir, (4) long-term effect, (5) impact on the Manatee County water plant, and (6) expected radium-226 levels in the raw and finished water supplies.

Effects on Stream Water Quality - The initial effect of a hypothetical dam break on either the North Fork or East Fork would be a temporary stoppage of flow upstream of the break point (caused by waste clays effectively damming the stream) coupled with a complete displacement of downstream water by the advancing front of waste clays. Extremely turbid conditions immediately following the spill may be expected to render the river temporarily uninhabitable for all but the most tolerant of organisms.

Review of available U.S.G.S. water quality data in the Peace River following the Cities Service settling pond embankment failure (December 3, 1971) indicated that turbidity levels were generally higher upstream of the spill than downstream. While the U.S.G.S. sampling events missed the actual peak in turbidity which was sufficient to cause extensive fish kills in the river, the data nevertheless indicate that average turbidities were at background levels within three to four months after the spill.

Based on the available data, the total phosphorus concentration downstream of the spill appeared to have risen slightly over background but remained well below the average phosphorus level upstream of the spill.

Short-term Impact on Reservoir- The short-term impact (i.e., within days to weeks following the accident) on the Lake Manatee

Reservoir was estimated by assuming complete and instantaneous mixing of the 1,000 acre-feet of clear water discharge from the clay settling area with the minimum 6,920 acre-feet of reservoir storage.

Estimated concentrations of TSS, TDS, fluoride and total phosphorus were slightly to moderately greater than background levels in Lake Manatee; butr in no case did a predicted concentration exceed the state standard for Class I-A waters.

Intermediate-term Effects of Suspended Solids Loading of Lake Manatee- As in the case of the Cities Service Peace River spill, it is anticipated that the elevated total suspended solids loading in the river (as indicated by turbidity) would persist for several months, gradually tapering off to the background levels as the exposed surface clays desiccated and vegetation re-establishes in the floodplain (Ardaman and Associates, Inc., 1979). The TSS concentration in the Manatee River was estimated to increase by 730 mg/l during the interim period. The additional sediment load over a two month period could deposit up to 60 acre-feet in the reservoir, a small amount relative to the remaining dead storage of 2,000 acre-feet (Ardaman and Associates, Inc., 1979).

The concentration of suspended solids at the intake structure to the water plant was estimated using Stoke's Law (American Water Works Assocation, 1971) and the known particle size weight distribution determined from a sample of waste clay from pilot plant runs with the proposed mine matrix (Ardaman and Associates, Inc., 1979a). It was conservatively estimated that 93% of the suspended solid would be removed; hence, a maximum of 52 mg/l could be expected to enter the lowermost water intake structure.

The above analytical prediction was verified through an independent, empirical method developed by Brune (1953).

Long-term Effects of Dissolved Constituents- Following the hypothetical accident, water entrained in clays deposited on the reservoir bottom and in the riverbed will slowly be expelled into the water column as the clays consolidate. Potential increases in concentrations of fluoride, TDS and phosphorus in the lake were examined. The predicted increase in fluoride level -0.004 mg/l over the background level of 0.45 mg/l - would have virtually no effect on the quality of the water supply. The effect of other constituents dissolved in the expelled water would be equally insignificant due to their substantial dilution by the relatively large volume of natural flow through the reservoir and water storage therein.

Effects on Water Treatment Plant Capacity- The intermediate-term increase in TSS levels in the reservoir will entail both beneficial and adverse effects with respect to the water plant's operation. Because of the affinity between suspended inorganic materials (such as clays) and organic compounds (EPA, 1967)(such as color) some reduction in the background color levels may be expected. On the other hand, the higher suspended solids concentration in the raw water would increase the quantity and possibly the density of sludge. An increase in alum dosage necessary to maintain effective coagulation-flocculation could also be expected. It is likely that the additional cost of treating an intermediate level of suspended solids (EPA, 1974) over a two to three month time span would be moderate compared to the total annual cost of supplying treated water to the system users.

The present sludge disposal facilities are susceptible to being overloaded in the event of a sudden increase in sludge loading. Hence, the increased rate of sludge production resulting from a hypothetical embankment failure might briefly exceed the present capacity of the drying beds and lagoon. Disposal of the small volume of addition sludge produced over a two to three month period would therefore require some expansion of existing drying bed and lagooning system.

Effects on Radium-226 in Manatee River and Reservoir- The evaluation of changes in radioactivity levels in waters affected by the hypothetical accident focused on radium-226, the most hazardous of the several radioactive species that are potentially involved in water contamination (Radiological Environment Resource Document). Because of the extreme insolubility of radium-226 in water (Radiological Environment Resource Document), the potential pathway by which radium-226 might enter the Lake Manatee reservoir is in association with suspended clay particles. Based on the maximum expected radium-226 concentration in the waste clay of 8 pCi/g (Radiological Environment Resource Document) and predicted TSS concentrations at the head of the reservoir and at the dam of 730 mg/l and 52 mg/l, respectively, the corresponding suspended solids components of radium-226 were estimated to be 5.8 and 0.4 pCi/l respectively. Conservatively taking the background level as 0.8 pCi/l, the total radium-226 concentration at the head of the reservoir and at the dam for a period of several months following the hypothetical embankment failure were estimated to be 6.6 and 1.2 pCi/l, respectively. Hence, the State's radium-226 standard of 5.0 pCi/l for Class I-A waters would be slightly exceeded at the head of the reservoir, but satisfied at the critical point of water intake to the treatment plant.

Importantly, the treatment process itself could be expected to further reduce the radioactivity level. As pointed out in the Radiological Environment Impact Resource Document "any treatment of waste waters for other water quality parameters has an inherent high efficiency for radioactive species in the same water".

Biological Effects: Biological effects caused by clay wastes from the hypothetical spill will be felt in the floodplain of the Manatee River, in the wetlands associated with the river upstream from the spill site, and in the Lake Manatee Reservoir.

Based on the effects of spoil placed on hydric swamps along the Apalachicola River in the Florida panhandle (Clewell and McAninch, 1977), the effect of the solids on the Manatee River floodplain would be to kill most trees and severly stress many of the surviving trees. The effects would be more severe if the spill occurred in the growing season rather than in the dormant season.

Following the spill the new substrate would be available for revegetation. Theoretically, a swamp community resembling the present natural swamp would develop gradually through plant succession. Whether or not such development would occur is speculative because there is no comparable site in the region which has undergone such perturbation and which has been allowed to undergo succession without further disturbance for several decades.

Since much of the land upstream from the site is scheduled for mining, the effect of ponding is mostly immaterial.

The spill would result in the destruction of the aquatic fauna of the river. Benthic organisms will be buried; other organisms will suffocate as their gills become clogged by the clays and silt. Few, if any, organisms will survive. Once the clays have settled, the river would begin to be recolonized by opportunistic species able to adapt to the new conditions. Species diversity would be low initially and increase as vegetation became re-established.

The spill would cause an increase of the water level in the reservoir by less than two feet. This increase will cause a minor readjustment of hydric vegetational zonation which will constitute a negligible impact. The effect of the spill on the limnetic zone would be a short-term reduction in productivity while turbid conditions persist.

The greatest impact would be the destruction of the present littoral zone in the upper end of the reservoir. The rather extensive vegetation, consisting of submersed and emergent aquatic plants would be destroyed. A new littoral zone would be created on the clays which would form the new substrate. From the angle of deposition, it is likely that the new littoral zone would be roughly one-third as large in area as the present littoral zone. The reduction in littoral zone area would reduce the biologic productivity of the reservoir.

Mitigating Measures

The following water treatment facilities and design features of the proposed mine will serve to mitigate the potential impact of mine discharges on receiving waters:

- o Wastewaters from ore transportation, washing, flotation, and waste disposal operations will be recycled to the water recirculation system for treatment in the clay settling area, thereby, substantially reducing a potential source of water pollution.

- o The 480-acre clay settling area will serve as an effective clarification facility, removing approximately 99.9% of the suspended clay solids.

- Runoff from active mining and reclamation areas, roadways, and the benefication plant area will be routed to the recirculation system for treatment.

- Domestic sewage generated during the construction phase of the mine will be treated with chemical toilets. Sewage generated during the operating phase will be treated in an on-site extended aeration treatment plant.

The following steps will be taken to prevent the possibility of a settling area failure and release of waste clay to the Manatee River:

- The settling area will be designed by an experienced professional engineer and be based on a thorough investigation of foundation and soil conditions existing at the proposed construction site.

- The rules of the Department of Environmental Regulation for the design, construction, inspection and maintenance of earthen dams promulgated under chapter 17-9, Florida Administrative Code will be strictly adhered to and complied with. The proposed mining operation will also comply with all other state and/or local ordinances concerning retaining dikes.

- The construction of the initial settling area will be inspected daily by a qualified representative of the design engineer to ascertain that the embankments, spillways, and control structures meet the design specifications. Prior to the introduction of waste clay into the area, the entire structure will be thoroughly inspected by the design engineer.

- The settling area will be visually inspected each eight-hour shift and will be thoroughly inspected on a weekly basis by operations personnel, who have been instructed by the design engineer, regarding items to be checked.

- A registered professional engineer, who is experienced in the design, construction, and maintenance of earthen dams will make annual inspections of the dam systems. He will also review on a monthly basis the reports of the operation personnel. A report of his findings will be submitted to the Florida Department of Environmental Regulation.

4.11 RADIOLOGICAL ENVIRONMENT

Baseline

The following will attempt to describe the background condition of the natural radiation environment in the absence of the proposed mining facilities. Specific items to be covered include the uranium series (particularily radium-226 and radon-222), radon progeny, terrestrial gamma radiation, airborne radioactivity, subsurface profiles of radioactivity, radium-226 in surface waters, and radium-226 in ground waters.

Primary apatite, the most common mineral of the phosphate group, contains only trace amounts of uranium, generally on the order of a few thousandths or hundredths of one percent or about four orders of magnitude higher than most other natural materials. Thus, apatite serves as a natural concentrator of uranium. When submitted to extensive marine reworking, the uranium content of sedimentary apatites may be increased to as much as 0.1%.

The uranium content of the phosphate matrix of west central Florida may average 120 ppm. Individual samples of selected strata may exceed 400 ppm U. The radiological hazard of the uranium ore is associated with individual isotopes and the decay products. The specific activity of U-238 is $0.33\text{x}10^{6}$ pCi/g.

The Primary Drinking Water Regulation - Radioactivity published by EPA in July 1976 limits the total radium in water to 5 pCi/l. Both radium-226 and radium-228 can contribute to this 5 pCi/l limit. Radium-228 is the first daughter of the naturally occurring thorium-232 series. In general, the world average concentration of thorium in various igneous rocks, limestones, and sedimentary rocks is about three times that of uranium (ppm basis). However, since thorium-232 has a specific activity, about one-third that of uranium-238, the radioactivity of the two radionuclides in many soils and rocks is more nearly 1:1 (pCi/g basis). Specific data on thorium-232 in Florida phosphate associated media indicate the U/Th ratio in terms of pCi/g per pCi/g to be about 100. Thus, radium-228 in west central Florida will be undetectable in most media.

In the uranium-238 series, decay proceeds serially through 13 intermediate radionuclides, called daughters, to a stable endpoint of the element lead with a mass number of 206. A condition of equilibrium is achieved if the entire series is contained in a "sealed" location over a long period of time. In other words, a geological sample containing 100 pCi of U-238 may also contain 100 pCi of Th-234, 100 pCi of Pa-234, 100 pCi of U-234, and so on, through 100 pCi of Po-210. Equilibrium is maintained only if the materials are undisturbed.

Radium-226 is of particular interest in regard to human exposure. Radium is chemically similar to calcium and replacement is clearly demonstrated by the high radium-226 concentrations found in the gypsum. Radium, like uranium, is ubiquitous in nature and is found in almost every environmental media.

The radium-226 decay scheme equilibrium is highly dependent upon the mobility of the radon-222, an inert gas. The four radionuclide daughters of radon-222 are known as radon progeny (or daughters of radon). In the natural unmined state, most of the radon-222 produced in a phosphate matrix would not escape the media. Mining and beneficiation alters the probability that radon-222 will be able to diffuse from the site at which it was created.

Subsurface Radioactivity - Since the origin of the uranium in the deposits is similar to the phosphate, it should be evident that the concentration of uranium and thus radium-226 should follow the concentrations of phosphate: a low concentration in the overburden and a high concentration in the matrix. The actual distribution is slightly different.

In the west central Florida mining regions, the radioactivity is low at the surface, increases gradually, and then more rapidly with depth and is most concentrated in or just above the matrix. The profiles indicate a wide variation with small distances within the matrix. Figure 4.11-1 shows the distribution of radium-226 samples versus depth for core samples at the Duette site. All uranium concentrations (pCi/g) were approximately equal to those of the radium-226. The radium-226 concentration in Duette site top soil averages 0.5 pCi/g or about same as the west central Florida top soil.

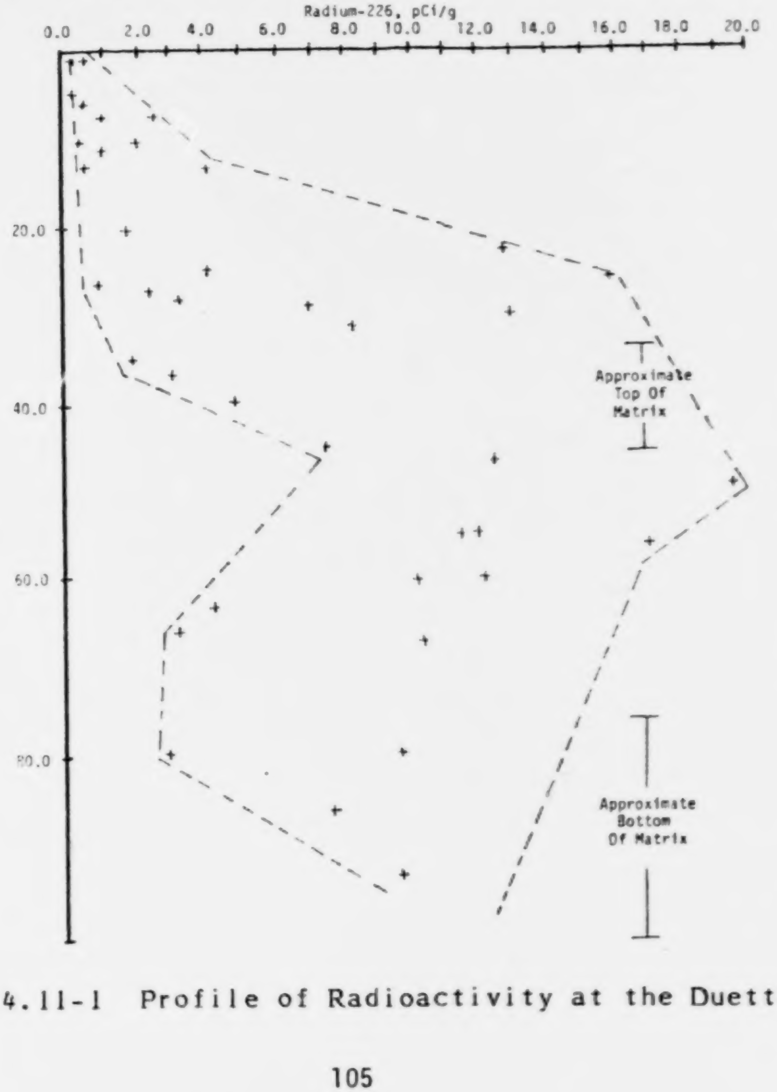

Figure 4.11-1 Profile of Radioactivity at the Duette Site

The overburden radium-226 data for the Duette site when compared to the west central Florida data of Roessler et.al. (1978) indicates that the Duette site has about 40% less radioactivity. Both the averages and upper ranges of individual samples indicate a matrix concentration of radium-226 at the Duette site that is much lower than the 26 pCi/g matrix of the west central Florida mining district.

Since a major fraction of the gamma radiation level in Florida is related to the uranium series, gamma logs of wells should also reflect the radium-226 profile shown in Figure 4.11-1. The gamma well log from the Duette site is shown in Figure 4.11-2. The gamma activity in Figure 4.11-2 (also relative radium concentration) increases nearly linearly with depth to approximately 35 feet where the rate sharply increases as does the phosphate level and then falls gradually to around the 100-foot mark. The mineable matrix at this core lies between the 35-foot and the 90-foot levels. Since the origin of the matrix is known to be linked to the Hawthorn Formation, the entire Hawthorn strata, here approximately 300 feet thick, would be expected to also contain uranium and its daughters because of its geologic history. The gamma log dramatically illustrates this fact.

By the method of graphical integration it is readily apparent that the combination of both the overburden and the mineable matrix represents only 8.1% of the total activity in the 1000-foot column. The remaining Hawthorn Formation from which the matrix was derived, represents about 50% of the total radioactivity within the 1000-foot column. The relationship of the deep aquifer radium and the high radioactivity in the total Hawthorn is not understood, however, current levels of radium in the aquifer may be more closely related to the lower Hawthorn than the matrix some 300 feet above.

Terrestrial Gamma Radiation - Table 4.11-A summarizes the estimated average background doses to United States citizens from natural radiations and compares it to estimates from other man-made sources. The total annual dose to an average United States citizen is about 182 mrem/yr. The largest fraction (58%) is contributed by environmental sources. The fraction of the environmental radiation dose of interest here is the external terrestrial radiation. This catagory can be enhanced by the technological activities of man, such as the mining and processing of ores.

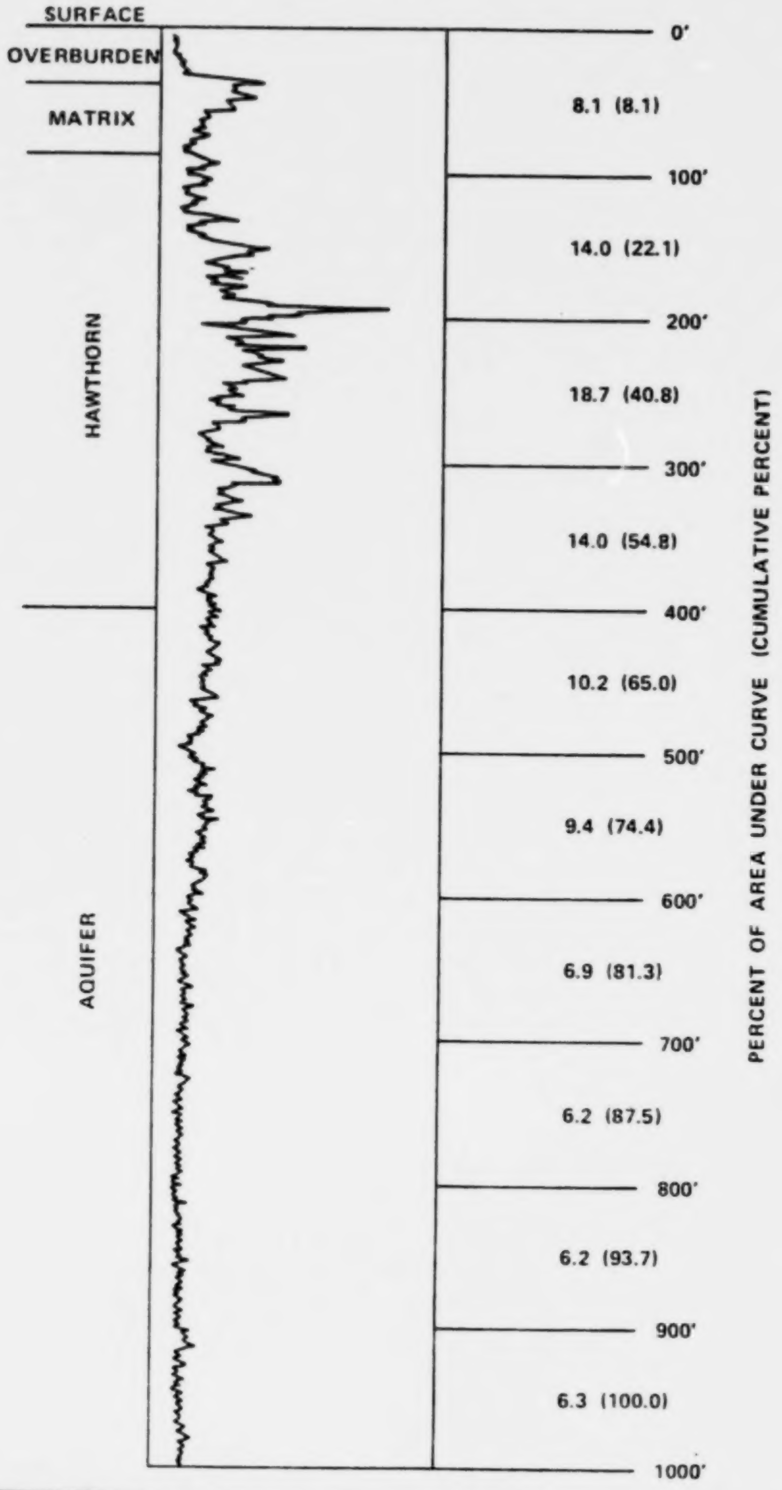

FIGURE : 4.11-2

GAMMA - RAY LOG OF A DEEP WELL ON THE DUETTE SITE

SOURCE : DR. E. BOLCH , P.E.

U.S. EPA - REGION IV
DRAFT ENVIRONMENTAL
IMPACT STATEMENT FOR
SWIFT AGRICULTURAL CHEMICALS
CORPORATION
PROPOSED DUETTE MINE
MANATEE COUNTY , FLORIDA

Table 4.11-A Average Doses from Radiation in the United States in 1970

Source	mrem/year*	Source	mrem/year*
Environmental		Medical	
Natural		Diagnostic	72
Cosmic Rays	44		
Terrestrial Radiation		Radiopharmaceuticals	1
External	40		
Internal	18	Miscellaneous	3
Global Fallout	4		
Nuclear Power	0.003	Grand Total	182

*Field measurements are usually made in units of μR/hr. For X- and gamma radiation 1 μR/hr ≈ 1 mrem/hr ≈ 8.8 mrem/yr.

In the continental United States, the external background terrestrial radiation arises primarily from gamma ray emissions of the thorium series, the uranium series and potassium-40; however, in Florida the contribution by the uranium series accounts for a high percentage. The overall average level in Florida (41 to 55 mrem/yr) is lower than the national average of 84 mrem/yr.

A radiological survey of the terrestrial gamma levels on the site reveal that the average total external gamma level for the entire property (over 200 measurements) is approximately 5.1μR/hr, which can be converted to an annual exposure of 45 mrem. Altered lands in west central Florida have elevated gamma radiation levels: sand tailings - 11 μR/hr, overburden reclaimed land - 13μR/hr, clay reclaimed lands - 17μR/hr and debris lands - 22μR/hr.

Airborne Radioactivity - Airborne radioactivity over unaltered lands arises from two major sources. Particulates containing the naturally occurring radioactive materials such as the uranium series become airborne as "dust". The second source is the diffusion of the gas radon-222 out of the soil surface.

In general, national ambient levels of gross beta activity in particulates range between 0.1 and 1.0 pCi/m^3. Gross alpha measurements average one to two orders of magnitude less. Partridge et.al. (1977) reported a summary of an ambient air sampling network for nonphosphate areas of Polk County. The data are compatible with the national ambient levels given above.

Radon-222 is a natural constituent of all air, but its concentration may vary over a wide range depending on the radium content of the upper layers of the earth and the prevailing meteorological conditions. Radon-222 content of ambient air at several locations in Florida ranges from 0.02 pCi/l in the afternoon to 0.3 pCi/l in the morning hours (Williams et.al. 1965).

Because of the wide variation in hourly measurements of radon-222 in air due to atmospheric conditions, radon-222 flux measurements from the soil surface have been determined to be a valuable indicator of potential environmental impact. The radon flux baseline level (unaltered lands) in west central Florida is about 0.2 pCi/m^{2}s and elevated levels over various types of phosphate related lands are observed: sand tailing - 0.7 pCi/m^{2}s, overburden reclaimed lands - 1.5 pCi/m^{2}s, clay reclaimed lands 1.6 pCi/m^{2}s, and debris lands - 4.2 pCi/m^{2}s.

Water Quality - Two water regimes will be considered with respect to radiological quality; surface waters and ground waters.

Radium-226 in surface waters of the USA is generally low (between 0.03 and 1.0 pCi/l). This same range is reflected in the measurments reported for Florida surface waters.

Table 4.11-B contains a summary of surface water radium-226 concentrations for the site and two downstream stations. The dissolved radium values were less than 0.8 pCi/l for four out of the six of the on-site samples.

Table 4.11-B Summary of Surface Water Radium-226 Concentration On Site and Off Site.

Description	Radium-226, pCi/l Undissolved	Dissolved
East Fork, Manatee River Entrance	<0.8	<0.8
East Fork, Manatee River Exit	<0.8	1.8 ± 1.1
North Park, Manatee River	<0.8	<0.8
Creek Crossing Rt.39 West Side	1.1 ± 1.1	<0.8
Small Stream, Middle of Track	<0.8	<0.8
North Fork, Manatee River Exit	0.8 ± 0.8	2.4 ± 1.0
Manatee River at Lake Manatee	<0.8	<0.8
Manatee River at Bridge, S.R. 64	<0.8	<0.8
Unreclaimed Lake-3' sample, 6' deep	<0.8	<0.8
Unreclaimed Lake, Surface Sample	<0.8	<0.8
Unreclaimed Lake-12' deep	<0.8	3.0 ± 1.1
Old Colony Mine Pit, Surface Sample	<0.8	1.2 ± 1.1
Old Colony Mine Pit, 12' Sample	<0.8	<0.8
Old Colony Mine Pit, 24' Sample	1.6 ± 1.2	1.2 ± 1.2
Settiing Area, Agrico	<0.8	<0.8

The water management program will determine radiological contamination during the mining phase, whereas the reclamation plan with its on-site drainage system and preventative measures against turbid runoff will determine the long term impact. It is important to recognize that radium is highly insoluble in comparison to other water quality parameters and measures to control other non-radioactive contaminates is normally sufficient to limit the impact of radium-226.

A review of the literature and analysis of radium-226 in groundwaters of west central Florida is presented by Kaufmann and Bliss (1977). They statistically analyzed available radium data from 1966 and from 1973-1976 in three strata: upper water table, Upper Floridan aquifer, and Lower Floridan aquifer. Each water resource was considered in three geographic areas of west central Florida: mined mineralized areas, unmined mineralized areas, and non-mineralized areas. The basic data summary is shown in Table 4.11-C.

Table 4.11-C Summary Of Radium-226 Data In Central Floridan Aquifers

Area Description	Aquifer Water Table No.	 pCi/l*	 Upper Floridan No.	 pCi/l	 Lower Floridan No.	 pCi/l
Unmined Mineralized	23	0.17	5	2.30	24	2.0
Mined Mineralized	12	0.55	10	1.6	16	1.96
Non-mineralized (Control)	NO DATA		3	5.1	14	1.4

Source: After Kaufmann and Bliss, 1977
* All data are geometric means of author's preferred data.

The mined area appears to have a higher radium-226 in the water table aquifer, but statistical tests indicate no significant difference between the 0.17 and 0.55 pCi/l.

When the Upper and Lower Floridan aquifer data were considered, mined areas and non-mined areas were all approximately equal. The comparison of non-mineralized data versus the mining areas showed that the Floridan had higher concentrations of radium-226 in the non-mineralized areas. The Floridan aquifer showed significantly higher levels than the water table aquifer.

Kaufmann and Bliss did not consider gamma logs of deep wells. Gamma logs to 1,000 feet show considerable radioactivity in the Hawthorn Formation overlaying the Floridan Aquifer. The gamma logs strongly suggest that the lower Hawthorn may itself be a source of radium-226 in the Floridan Aquifer. The literature values for radium concentrations in ground waters appear to follow the same pattern with depth as the deep gamma logs.

Because radium-226 is found in all subsurface strata at various concentrations including some that are much higher than the mined matrix, the identification of ground-water contamination beyond natural causes and the determination of its source is an exceedingly complex problem.

Summary - Baseline conditions at the proposed site are as follows:

Subsurface Radioactivity - Uranium and radium-226 measurements confirm high activities either just above or in top of the matrix. Overburden has concentrations of radioactivity typical of west central Florida, however, the Duette matrix is deeper than in most current mines. Uranium and radium-226 continues throughout the matrix and into the Hawthorn and exceed the matrix concentrations.

Gamma logs show high levels at the top of the matrix, some continued higher radioactivity through the Hawthorn with a decrease within the Floridan Aquifer.

The U/Th ratio in subsurface strata is much greater than the national average. Thus, radium-228 is not considered a potential contaminant.

Matrix Radioactivity - Radium-226 is approximately 5 to 8 pCi/g or less than one-third of that observed at currently operated mines in west central Florida.

Gamma Radiation - The external gamma radiation is approximately 5.1 R/hr over unaltered lands on the site. Typical Florida background radiation ranges from 4.7 to 6.3 R/hr.

Airborne Radioactivity - The agricultural nature of land indicates low airborne particulate activity: less than 0.01 pCi/m3 gross beta, and less than 0.001 pCi/g for specific long lived radionuclides such as Uranium-238, Thorium-230, Radium-226, etc.

Ambient levels of radon-222 are expected to be less than 0.1 pCi/l.

The surface flux of radon-222 on the unaltered site is expected to not exceed 1 pCi/m^{2}s.

Surface Water Radioactivity - Radium-226 levels are between less than 0.8 to 2.4 and normally less than 1 pCi/l. These values are higher than the national average, but comparable to other surface water in unmined areas of Florida; Uranium and Radium-228 concentrations in surface waters are below normal detection limits.

Ground Water - Radium-226 levels are between less than 0.8 and 6 and normally less than 3 pCi/l in important aquifers. Concentration appears to be related to depth and, therefore, to radium in the immediate media. Poor water quality, especially Na+ (or Cl-), may enhance radium content.

Impact

The proposed Duette mine may alter these baseline conditions. This section will: 1) describe the redistribution of the radioactivity and radiation, 2) propose potential contamination and exposure pathways, 3) predict or estimate the effects on man or the environment, 4) provide a comparative measure and perspective, and 5) substantiate the basis for any mitigative measures.

In the mining process, overburden must first be stripped to gain access to the matrix. Core analyses have shown the radium-226 profile in the site overburden to range from less than 1 pCi/g near the surface to a high of about 18 pCi/g at the matrix interface.

The matrix must be removed and slurried to a washer/beneficiation plant. The complete process and distribution of radioactivity for current practice (Roessler et al., 1978) is compared to the Duette site in Figure 4.11-3. The west central Florida clays average about 45 pCi/g for radium-226. By pilot plant studies with the matrix, the clays at the proposed site range from 3.2 to 5.6 pCi/g radium-226. The radium-226 in pebble from the site is approximately one-half of the average in the west central Florida plants. The west central Florida tailings now average about 5 pCi/g, while Duette pilot plant tailings have a radium-226 concentration of 1 pCi/g.

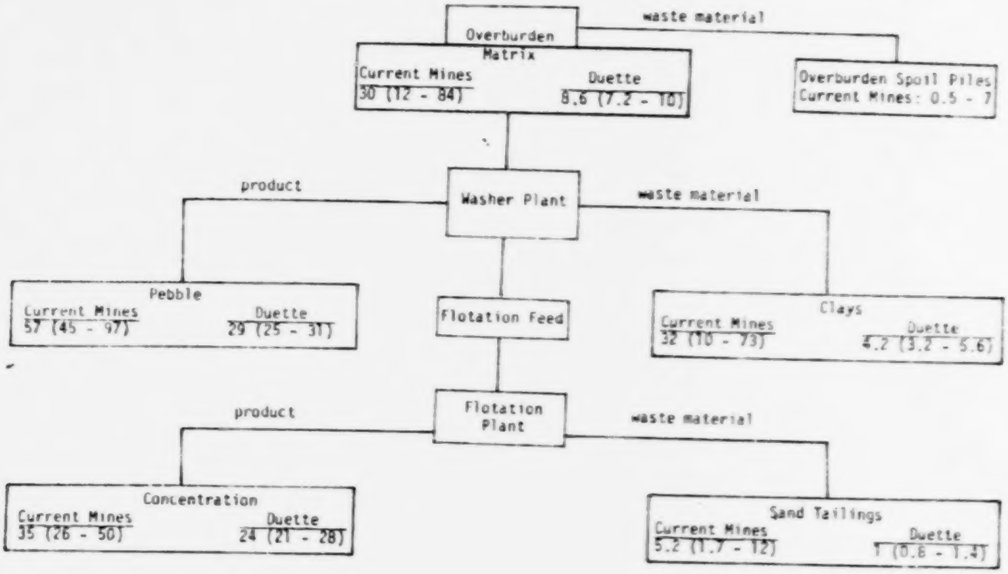

Figure 4.11-3 Comparison of Radium in Current Central Florida Products and Wastes to Expected Values at the Duette Site

A potential direct impact of mining and beneficiation is that of occupational radiation exposures at either the dragline area or beneficiation plant. However, Prince (1977) surveyed six west central Florida plants and found radiological impacts to operating personnel at mining and beneficiation processes were minimal.

Potential occupational exposure hazards to be considered at drying, storage, and shipping operations are gamma radiation doses, exposure to radon progeny, and inhalation of long-lived radionuclides. Exposure locations include storage areas, loading tunnels, dryer buildings and rock loading areas.

Prince (1977) has studied the occupational radiation exposures in these phases of the industry. Wet rock storage piles yielded the highest average gamma radiation level of 67μR/hr. However, extremely small occupancy times made individual annual exposures insignificant.

Prince's results for airborne radon progeny hazards indicated the rock pile transfer tunnels, especially when unventilated, to be the most serious hazard. The Duette operation, having both a lower radioactivity concentration in the stored material and properly ventilated tunnels, should not experience adverse occupational exposures.

The existing profiles of radioactivity with depth will be altered by the mining and subsequent reclamation. The radium-226 (and uranium-238) concentration in the post-mining overburden can be estimated to be 1.5 pCi/g. Any stored topsoil to be replaced should have a lower radioactivity (x0.5 pCi/g). The two waste products, sand and clay, when combined at a proposed 2.5:1 ratio will have a final radium-226 concentration of 1.9 pCi/g.

The reclamation plan calls for 80% of the reclamation to be with this sand clay mixture. Another 13% will be by covering sand tailings with two feet of overburden. The remaining 7% of the reclaimed land will be the final clay setting area.

Alteration of Terrestrial Gamma Radiation - The redistributed radioactivity in reclaimed lands will alter the terrestrial gamma radiation. Table 4.11-D illustrates the elevation of gamma radiation as a result of current mining. However, the lower radioactivity at the Duette site will not experience the degree of elevation of gamma radiation that has occurred over various land types in Polk County.

The predicted impact has been estimated by consideration of the expected uranium, thorium, and potassium contents of various post reclamation land types and the equations of Beck and de Planque (1968). No credit was taken for any low activity topsoil or its shielding properties. The predicted total external gamma radiation levels were 7.1 μR/hr for overburden reclaimed, 8.7μR/hr for the sand/clay mixture, 5.9μR/hr for tailings reclaimed, 13.8μR/hr for clay reclaimed and a weighted average for the site of 8.8μR/hr.

Table 4.11-D Gamma Radiation Levels of Various Land Types in Florida

County & Land Type	No. of Sites	Gamma Level, μR/hr Geom. Mean	Gamma Level, μR/hr Range
Polk Co.			
Unaltered	9	5	4-7
Unmined Radioactive Fill	1	9	-
Sand Tailings	11	11	6-16
All Overburden Reclaimed	16	13	7-33
Capped and Mixed Clays	6	17	11-24
Debris	8	22	11-54
Alachua Co.			
Unaltered	6	6	5-8

after Roessler, et. al. 1978

Airborne Radioactivity - Fugitive dust control has been adequately addressed in other sections. The impact of the dryer emissions, however, requires further consideration. Offsite transport of the radioactivity and subsequent potential radiation doses to the general public can be estimated by the use of EPA computer code: AIREM (Martin, et al. 1974). AIREM is a computer code for the calculation of doses to the general population due to atmospheric emissions of radionuclides. The input data and requirements for AIREM calculations are presented in the Radiological Environment Resource Document. Ten segments at radii of 100 meters to 10 miles were used.

Dryer Emissions: The two rock dryers proposed for the facility will utilize cyclone particulate collectors and wet scrubber collection devices. The scrubber exhausts will discharge through stacks.

Dry deposition at the nearest offsite location to the north of the plant would add approximately 30 pCi/m^2 per year of radium-226 to the soil. Since topsoil has about 0.5 pCi/g and a density of about 1.4 g/cc, the first centimeter of soil will normally contain 7000 pCi/m^2.

Lung dose calculations indicated an offsite dose for continuous exposure of 0.4 mrem/yr one mile north and at Keentown some 2 miles NNW of the plant the predicted lung dose rate is 0.15 mrem/yr. Neither annual dose at these offsite locations can be measured within the statistical variation of natural background.

Radon Flux from Reclaimed Lands: Radon-222 flux from the soil surface will be increased due to the redistribution of radium-226 in the reclaimed lands. Radon in the atmosphere will experience some elevated concentration due to this increased surface flux.

The predicted radon flux values for various land types of the post-reclamation phase is as follows: overburden reclaimed -0.75 pCi/m^{2}s, sand/clay mixture - 0.84 pCi/m^{2}s, tailing reclaimed - 0.46 pCi/m^{2}s, clay sediments - 1.04 pCi/m^{2}s and the weighted average for the site - 0.80 pCi/m^{2}s. Any topsoil of lower activity added to any of these land types will reduce these flux values. The elevation of outdoor airborne radon-226 from these fluxes will not be significant.

Reclaimed Land Use - The reclaimed lands will have different radiological characteristics than the land before mining. Two radiation exposure pathways appear to be most directly related to reclamation and land use: 1) working level (WL) elevation in residential structures; and 2) uptake of radionuclides into agricultural products.

The impact of residential development must be considered, whether for small numbers of homes in the immediate future or significant numbers in the future.

Certain land parameters have been shown to predict indoor radon progeny in slab-on-grade constructed homes in west central Florida (Roessler et al. 1978). The predicted indoor radon progeny levels by land type for the Duette site after reclamation are as follows: overburden reclaimed -0.008 WL, sand/clay reclaimed - 0.009 WL, tailings reclaimed - 0.006 WL, clay sediments - 0.015 WL and the weighted average for the site - 0.009 WL. No credit was given for topsoil replacement in the calculations.

If the final guidance (EPA, 1979) for reclaimed lands suggests an upper limit of predicted radon progeny in slab-on-grade homes of 0.009 WL (normal background of 0.004 WL plus the uncertainty of 0.005 WL) then the Duette site may have to consider the return of topsoil to any residential development site. If clay settling areas are excluded for structural reasons, then no reclaimed Duette site lands are predicted to produce homes with radon progeny levels near the 0.02 WL remedial action level (EPA, 1979).

Some 68% of the land is expected to be improved pasture and a very small percentage (less than 5%) may be used for citrus and row crops. The scientific literature contains little information on the potential for crop uptake of radium-226. Most literature data suffers from the lack of companion information on other nutrients in the soil and in the crops.

The return of any low activity topsoil to reclaimed areas will substantially reduce any potential impact. The most important pathway to consider is the direct uptake by row crops grown on the reclaimed clay. Here the radium-226 content is the highest and land will be suited for this productive use. Little is known about the behavior of radium-226 uptake from this type of soil. A very limited study suggest that the excess availability of the major divalent cations (Ca++ and Mg++ primarily) produce a discrimination against uptake of Ra++ in the clay soils containing higher than normal radium-226.

Since current fertilizer products such as TSP may contain up to 32 pCi/g radium-226, the direct application of fertilizer products to crops may be much more important than direct uptake from the reclaimed soil being farmed.

Product Radioactivity - The offsite shipment will be 62 million tons of phosphate rock at 21 and 31 pCi/g of radium-226 and uranium. The secondary impacts of these materials will depend upon the location of any additional processing, the final product and its end use.

Water Quality - Radioactivity represents one of many water quality parameters. Ground water and surface waters represent the two major pathways of transport to man and each will be discussed separately.

The important guideline for radioactivity in drinking water is that the combined radium-226 and radium-228 shall not exceed 5 pCi/l. The EPA has established an effluent guideline for the phosphate industry of 9 pCi/l of radium-226.

Surface Water Quality: A review of the various studies related to the current phosphate mining indicate that three factors appear to mitigate the impact of radioactivity upon surface waters of the phosphate district: a) The critical nature of water resources encourages a high degree of recycle of water within the process systems, b) The important radioactive species, like radium-226, are extremely insoluble under many environmental conditions, and c) Any treatment of waste-waters for other water quality parameters has an inherent high efficiency for radioactive species in the same water.

Mills et al., (1977) have reviewed the beneficiation process with respect to radioactivity in water. Adjusting their findings and conclusions to the radioactivity of the Duette site, the concentration of radium-226 in the discharge from the clay settling area is expected to be normally <1 pCi/l. The beneficiation process itself is an extreme opportunity for leaching and should lead to fractionation of the radium-226 from the minerals if radium-226 were not so insoluble. Surface water contamination in runoff from reclaimed areas is predicted to yield an equilibrium concentration of radium-226 in contacted water of no greater than 0.2 to 2 pCi/l. These values would tend to be further diluted by runoff from areas having less radium-226 in the soil and by waters from other sources.

Ground-water Quality: An analysis of the areawide impact statement and other site specific DRI's and EIS's indicate that radioactivity is not normally the critical water quality criteria. Some of the same conclusions stated for radioactivity in surface water (recycle uses, species insolubility, and high removal efficiencies) are just as valid for reducing the potential for ground-water contamination.

The areawide impact statement for the industry (EPA, 1978) recommended that recharge water from the connector wells should meet recommended drinking water criteria chemically, bacteriologically, and radiologically at all times. The radioactivity levels in the shallow aquifer water at the Duette site should be acceptable for recharge to the Floridan aquifer.

It is important to re-emphasize that any existing radium-226 in ground waters, especially in the Floridan aquifer, may have a variety of sources and the most likely source is the naturally occurring radium-226 in the lower Hawthorn. This fact also makes it exceedingly difficult to "trace" radium-226 to its source, since nearly all materials and strata contain measureable quantities.

Summary - The radiological impact of the proposed Duette mine, its beneficiation process and other activities are as follows:

Matrix Radioactivity - Radium-226 (9 pCi/g) in the matrix, some forty feet below the surface, will be mined and partitioned into waste clays (4 pCi/g), sand tailings (1 pCi/g), product pebble (29 pCi/g) and product concentration (24 pCi/g).

Subsurface Radioactivity - Pre-mining radium-226 profiles (<1 pCi/g at the surface to 18 pCi/g near the matrix) will be altered to a reclaimed profile having from between 1 and 4 pCi/g nearly uniformly distributed with depth.

Occupational Exposures - The highest potential for occupation exposure would be in loading tunnels unless they are ventilated and occupancy times restricted.

Terrestrial Gamma Radiation - The mean outdoor gamma radiation of the site is expected to increase from 5.1 μR/hr to 8.8 μR/hr.

Airborne Radioactivity - Dryer and other airborne emissions are expected to deposit over half of the radioactivity within a radius of 7.5 miles. The yearly depositon (pCi/m^2 per year) beyond one mile would not increase the radioactivity of the soil to any measurable degree.

Lung dose calculations indicate the highest dose rate for continuous exposure to be 6 mrem/yr at 500 meters west of the stack. All lung dose rates for continuous exposure beyond 1.5 miles are less than 1 mrem/yr.

Radon flux from the soil surfaces of the site are expected to increase from a baseline of 0.2 pCi/m^2s to less than 0.8 pCi/m^2s.

Elevation of outdoor airborne radon-226 is not expected to be measurable.

Land Use Criteria - Residential development for the site is not expected within the immediate future. For any homes that are constructed, the predicted indoor radon progeny (WL) could range from .005 WL (tailings reclaimed) to 0.023 WL (clay settling areas).

Agricultural development of the site is not predicted to pose any radiological impact from the limited soil-to-crop-to man food chain uptake.

Surface Water Radioactivity - Surface water radium-226 concentrations in off-site environs may be elevated from natural levels of 0.8 pCi/l to 2 pCi/l. By comparison, the drinking water standard for radium-226 is 5 pCi/l and the discharge guideline for the industry is 9 pCi/l.

Ground-water Radioactivity - The ground-water radium-226 concentratons at the site are less than those observed in non-mining regions. Radium-226 in ground waters appears to be associated with local subsurface environments.

The connector wells for recharge of the Floridan aquifer represent a potential transport mechanism for radioactivity. However, monitoring of the more basic water quality parameters should prevent contamination by radioactivity.

Mitigating Measures

Mining, Beneficiation, Storage, and Shipping - Specific mitigative measures are not indicated for these processes. The lower radioactivity of the matrix and subsequent products reduces the concern for any occupational exposure, although ventilation of transfer tunnels and limited occupancy is beneficial.

Drying and Airborne Emissions - Detailed computer analysis of radioactivity emissions and dispersion from the dryer facilities indicate no species controls because of radiological hazards. Reviews of the literature and other environmental assessments indicate that adequate control of other air quality criteria, such as particulate standards, mitigates the radiological emissions to acceptable levels.

Reclamation - The proposed reclamation plans combined with the deeper, lower activity overburden and the smaller level of radioactivity in the primary waste products (sand and clay) appear to satisfactorily mitigate most of the post-reclamation radiological conditions to acceptable levels. The sand-clay mix reclamation has acceptable radiological characteristics with respect to 1) alteration of terrestrial gamma radiation, 2) changes in radon-222 flux from the soil surface, 3) airborne radon-222, 4) postulated radon progeny in any residential homes, 5) agricultural uses or 6) return to natural systems.

All post reclamation criteria for the radiological environment were estimated without returned topsoil. The mining plans, however, suggests that approximately 2 feet of topsoil may be returned to some of the reclaimed areas. This procedure is recommended, since expected guidance for construction of residential homes may require near background levels. The final clay settling area when returned to any land use will be most beneficially affected by returned topsoil. The 3-4 feet of returned topsoil recommended in the EPA Areawide EIS may have a high cost-benefit ratio in this region of lower matrix radioactivity.

Surface Water Quality - No specific mitigative measures are recommended for the radiological quality of waters released during the operational phase other than meeting the 9 pCi/l effluent guideline. Water quality data of other investigations indicate that non-radiological parameters are the critical discharge criteria. The extremely high insolubility of radium results in its high efficiency of removal when treatments are applied to maintain the chemical aspects of discharge permits.

Calculations indicate that post-reclamation runoff would not produce radium-226 levels in surface waters significantly higher than background levels.

Ground Water Quality - The connector wells for drainage appear to be the critical aspect of potential ground-water contamination. However, all data indicate that the levels of radium-226 in the drainage water are lower than the deeper aquifers. Here again there is the high probability that another chemical parameter will be the critical agent necessary to monitor in order to insure that the drained water meets drinking water criteria. Radium-226 is not expected to exceed the 5 pCi/l.

Conclusions - In general, no mitigative measures specific to radiation appear to be necessary. This is, however, pedicted upon the various mitigative measures designed into the non-radiological aspects of the mine operation and detailed in specific sections of this EIS.

4.12 BIOLOGY AND ECOLOGY

Baseline

The biological and ecological characteristics of the property are presented under three major headings based on vegetation associations:

- Land - description of terrestrial plant and animal communities
- Land/Water Interface - description of plant and animal communities inhabiting swamps and marshes
- Water - description of aquatic plant and animal communities

Studies revealed four land communities, three land-water interface communities, and three stream communities. All communities showed some modifications from logging, cattle grazing, and/or decreased frequency of fire.

The system of community classification used is adapted from the classification of forest cover types by the Society of American Foresters (1954), the classification of wetland vegetation by the U.S. Fish & Wildlife Service (Shaw & Fredine, 1956), and the classification of cover types in Florida by the Division of State Planning (1976). Figure 4.12-1 maps existing vegetation communities.

Land - The existing land communities are sand pine scrub, longleaf pine-xeric oak, xeric oak, and longleaf pine flatwoods.

Sand Pine Scrub: Two stands of sand pine scrub comprise 73 acres. Typical species include sand pine, rosemary, staggerbush, chapman oak, sand-live oak, myrtle oak, and tallow wood. Scattered plants typical of the longleaf pine-xeric oak community are also present, including longleaf pine and wiregrass. The earlier literature on the sand pine scrub community stated that these two communities were distinct. Later authors noted that the species of the sand pine scrub community have invaded adjacent stands of longleaf pine-xeric oak after the exclusion of fire for an extended period (Nash, 1895; Harper, 1915, 1921; Mulvania, 1931; Kurz, 1942; Laessle, 1967). It is presumed that the sand pine scrub community of the Swift property has expanded somewhat into adjacent areas of longleaf pine-xeric oak.

The sand pine scrub community occurs on well drained, sterile sands and is characterized by an overstory of sand pines and a dense or at least thickety type undergrowth of shrubs with coriaceous, evergreen leaves. Species richness is low, particularly in relation to adjacent longleaf pinelands, and grasses and forbs are sparse.

The sand pine scrub is less productive in terms of animal life than other communities of the property. Faunal food resources are limited largely to acorns, pine seeds, fruits of the tallow

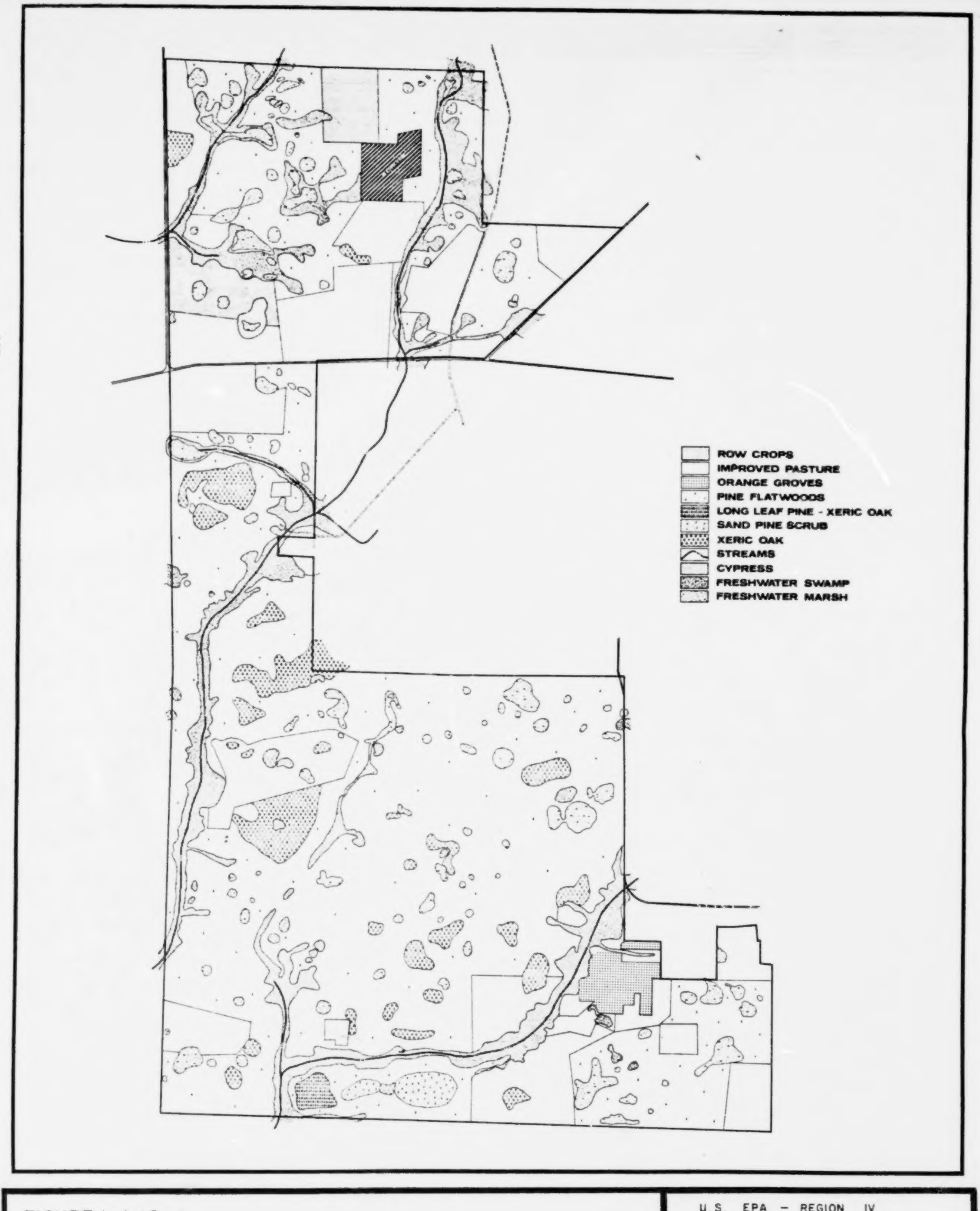

FIGURE: 4.12-1

VEGETATION

SOURCE: CONSERVATION CONSULTANTS, INC.

U.S. EPA – REGION IV
DRAFT ENVIRONMENTAL
IMPACT STATEMENT FOR
SWIFT AGRICULTURAL CHEMICALS
CORPORATION
PROPOSED DUETTE MINE
MANATEE COUNTY, FLORIDA

wood, insects, and twigs. The undergrowth provides some shelter to non-avian animals (Poppleton et.al., 1972).

Animals seen in the scrub were gopher tortoise, six-line race runner, armadillo, ground dove, blue jay, and cattle egret. Several areas had been rooted by feral hogs. The burrows of gopher tortoises are known to provide shelter for other animals, which would otherwise be unable to survive the arid habitat of the scrub (Ernst and Barbour, 1972; Hartman, 1976). There is probably little interaction of consequence between the animals of the scrub and those of other habitats. The only animal directly utilized by man in the scrub is the feral hog.

Longleaf Pine-Xeric Oak: This community is represented by one small 35 acre stand. The overstory consists solely of longleaf pine with a canopy closure of about 50-75%. The understory consists primarily of turkey oak and sand-live oak. The undergrowth is primarily of wiregrass and other herbaceous species, including golden-asters, deer's-tongue, gopher apple, polygonella, and wing-stem. The species seen were the same as those in the xeric oak community.

This community was once widespread in peninsular Florida, but because of clear cutting of the pine, much of it has been converted into xeric oak community. Pines have not become restocked mainly for lack of a seed source. Even with the availability of seed trees, restocking is retarded because of erratic seeding, the requirement of a fire immediately preceeding seedfall for seedbed preparation, and the infrequency of favorable moisture conditions (Wahlenberg, 1946).

The fauna is treated under the Xeric Oak section as the communities are essentially the same faunistically.

Xeric Oak: This community occupies a total of 518 acres and is dominated by sand-live oak and/or turkey oak. These small shrubby oaks have a canopy closure of about 50%. Other woody growth includes saw-palmetto, fetterbush, staggerbush, Chapman oak, tallow wood, and scrub palmetto. Wiregrass and many other herbs form the rather dense ground cover. Longleaf pine stumps were common throughout, which is proof that the xeric oak community was derived secondarily by the removal of these pines by clear cutting. The abundance of saw-palmetto and fetterbush suggests that part of this community may have been cutover longleaf pine flatwoods.

Animals seen were gopher tortoise, scrub jay, blue jay, ground dove, mourning dove, rufous-sided towhee, and armadillo. The community does not have diverse fauna. Perhaps the uniformity of habitat and the lack of cover for birds and larger mammals contribute to the paucity of the fauna. Animals that would be expected but were not seen are the oak toad, gopher frog, six-lined race runner, Florida mouse, old field mouse, golden mouse, and Florida skink (Rand and Host, 1942; Dickerson, 1969; Cochran and Goin, 1970; Hartman, 1976). Gopher tortoise burrows are more abundant in the xeric oak community than in any other habitat on the property. Golden mice tend towards arboreal habits and should occur in areas with larger sand-live oaks (Rand and Host, 1942; Lowery, 1974).

Several species found in the xeric oak scrub, such as the old field mouse, gopher tortoise, and doves breed both in the xeric oak as well as their habitats. However, scrub jays nest in xeric oak and sand pine scrub but nowhere else. (Harrison, 1975). The amphibians breed in wet areas.

Flatwoods animals may enter the oak scrub on an intermittent basis for food and shelter, and species characteristic of xeric oak may spend part of their time in other habitats.

Animals occupying the xeric oak which are of potential use to man, are the feral hog and mourning dove.

Longleaf Pine Flatwoods: The overstory consists of an open stand of longleaf pine on the higher sites with intermixed slash pines on the lower, wetter sites. Logging has reduced the canopy closure to less than 10%. This community is present on 5,673 acres of the property. Important in the dense undergrowth are gallberry, saw-palmetto, fetterbush, wax-myrtle, blueberry, runner oak, wiregrass, and many other herbaceous species, particularly grasses and composites. The flatwoods tend to be more shrubby near the marshes, probably because of increased moisture and less flammable conditions.

Animal species seen in the flatwoods include the feral hog, mourning dove, bobwhite quail, cottontail, red fox, opossum, and deer, all of which are useful to man. Other animals that are common in pine flatwoods include the southern toad, tree frogs, glass lizard, diamond back rattlsnake, wild turkey, grey squirrel, fox squirrel, skunk, cotton rat, least shrew, and harvest mouse (Rand and Host, 1942; Poppleton et al., 1972; Layne, 1974). Loss of the pines on the property reduced the habitat for aboreal species, such as perching birds, tree frogs, and squirrels.

Ruderal Vegetation: Ruderal vegetation occupies 2,258 acres where land communities have been disturbed by intensive land use, mainly improved pastures, row croplands, and citrus groves, also roadsides, ditches, and abandoned homesites.

The more disturbed areas contain a variety of weedy plants. Intentionally introduced species include orange, bahia grass, tomato, and watermelon. The pasture lands have been improved to various degrees by land clearing and the seeding of bahia. In many places the native vegetation has become partially re-established.

No non-domestic animals live or breed exclusively in ruderal areas. Several are seen commonly in such areas, though. Among them are the black racer, armadillo, opossum, cotton rat, house rat, and Norway rat. The red fox, which was introduced widely in Florida, is often seen in fields (Naggair, 1976a). One was recorded dead on State Road 62 at Duette during the time of the survey. The least shrew primarily inhabits old broomsedge fields

(Golley, 1962) . Birds seen commonly in ruderal areas of the Swift property are the kestrel, cattle egret, sandhill crane, common crow, meadow lark, and killdeer. Less common species are bobwhite quail and mourning dove. Burrowing owls were seen on an adjacent ruderal site. Many animals breed in ruderal habitats, especially small mammals and ground-nesting birds. The ruderal habitats contain wildlife food plants, including cultivated crops like corn. The exploitation of these food sources by animals of nearby natural habitats represents an interaction betwen ruderal and native communities.

Land-Water Interface - These communities are fresh water swamp (1,219 acres), fresh water marsh (600 acres), and cypress (18 acres).

Fresh Water Swamp: Major stream floodplains contain a densely forested swamp community. The vegetation is heterogeneous, reflecting the diversity of habitat. Broad intergradations between vegetational extremes, though, precludes the recognition of more than one swamp community.

Canopy closure approaches 100% with Laurel oak the most dominant species, followed by red maple and swamp tupelo. Carolina ash is important for its high density. Stumps of slash pine attest to its greater prevalence in the past. The natural restocking of slash pine appears to be limited to areas where the canopy is broken and sunlight reaches the ground.

Plants of non-arboreal species are rather sparse, owing to the shade from the canopy. Understory species include blue dogwood, American hornbeam, Walter's viburnum, buttonbush, wax myrtle, storax, and persimmon. Shrubs are scattered or sometimes form small thickets, especially in bayheads. Epiphytes are conspicuous and include two orchids, Encyclia tampensis and Harrisella porrecta .

The swamps of feeder creeks are characterized by an increase of trees having broad, evergreen leaves, particularly sweetbay, swampbay, and loblolly bay. Other common plants are slash pine, viburnum, blueberry, lizzard's tail, and sphagnum moss. In Florida such sites are called bayheads, referring to the predominance of bay trees in headwater sites.

Animals observed in the fresh water swamp are the indigo snake, raccoon, feral hog, grey fox, and cotton mouse. Other animals expected are: short-tailed shrew, marsh rabbit, river otter, opossum, grey squirrel, bobcat, long-tailed weasel, American alligator, wood duck, barred owl, redbellied woodpecker, blue-grey gnatcatcher, eastern bluebird, and others, including many species of migratory birds (Cowell et al., 1974). Animals of use to man include the feral hog, raccoon, opossum, grey squirrel, grey fox, otter, bobcat, marsh rabbit, wood duck, indigo snake, and American alligator.

Fresh Water Marsh: Shallow temporary ponds with emergent marsh vegetation are scattered throughout the property. These ponds are catch basins receiving surface runoff during wet seasons with maximum depths of 2 to 2.5 feet. The water table drops just below the soil surface during the dry season in years with near-normal rainfall, except in the deepest portions where floating-leaved aquatics grow. Even these deep areas dry out in years of subnormal precipitation.

The marshes exhibit vegetational zonation with respect to water depth. The deeper water contains St. John's wort; creeping rush; mermaid weed; floating hearts; sphagnum moss; species of Ludwigia and Sagittaria ; pickerelweed; and sawgrass. The shallower edges support coinwort, spikerush, broomsedge, yellow-eyed grass, pennywort, and many others. Small thickets of shrubs are scattered about, mainly occupying slightly elevated spots within the marsh. Between marshes there is considerable variation in dominance, and to a much lesser extent, species composition.

Birds comprise the largest group of vertebrates utilizing the marshes. Observed were the great blue heron, little blue heron, cattle egret, green heron, Louisiana heron, common egret, white ibis, wood stork, sand-hill crane, belted kingfisher, red-winged blackbird, brown-headed cowbird, and pied-billed grebe. Other common vertebrates include mosquitofish, least killifish, golden topminnow, pygmy sunfish, leopard frog, little grass frog, chorus frog, cricket frog, mud turtle, musk turtle, American alligator, rice rate, Florida water rat, and marsh rabbit. Raccoons are attracted to the abundant crayfish. Feral hogs root about along the edges of the marshes.

The marshes serve as breeding and feeding areas for numerous species. Most frogs and toads of the region breed in flatwoods ponds and marshes (Conant, 1958; Cochran and Goin, 1970). The larger wading birds nest in trees but require marshes for feeding areas (Harrison, 1975; Reilly, 1968). The red-winged blackbird, pied-billed grebe, sandhill crane, and other birds nest in and near the marshes Burleigh, 1958; Harrison, 1975). Useful animals include the raccoon, feral hog, and marsh rabbit. Animals that are largely confined to other habitats may depend on marshes for water in dry seasons.

Cypress Swamp: A single 18 acre cypress area is comprised of an interior 5.4 acre shallow marsh surrounded by an overstory of pond cypress. The sparse understory consist of shrubs and small trees which grow predominantly on tops of rotting cypress stumps just above the high water mark. Herbaceous growth is abundant where openings in the canopy allow light to enter but elsewhere scattered plants of marsh and serpent ferns and a dense floating mat of liverworts persists. A St. John's wort, Triadenum virginicum , heretofore unknown from Manatee County, was observed.

Birds and animals which spend much of their time in other habitats may use cypress swamps for nesting, protection from predators, and as a source of water during droughts. Animals recorded include pig frog, green anole, southern leopord frog, mosquito fish, red bellied woodpecker, pileated woodpecker, song sparrow, bobcat, cotton mouse, and fox squirrel.

Water - The property contains three stream segments: East Fork Manatee River, North Fork Manatee River, and the Little Manatee River. The streams are generally devoid of aquatic plants due to dense shade cast by the overhanging swamp forests. A few areas that lack a dense canopy, though, support growths of spatter dock, evening primrose, para grass, pondweed, alligator-weed, and Nitella sp. Interruptions in the canopy are often the result of disturbance by man.

Stream Metabolism: Little submerged or emergent vegetation is present and the lack of vegetation is reflected in low gross primary productivity. Community respiration was also low. Respiration exceeded production indicating the stream system relies on an outside source of energy. This conclusion is corroborated by the oxygen saturation data. The dissolved oxygen level was always less than saturation indicating more organic matter is being consumed than produced (Odum and Hoskin, 1958).

Fifty-three periphyton taxa were identified with fourteen species accounting for about 90% of the total periphyton abundance. Community characteristics such as density, biomass, and species richness indicated natural spatial and temporal variation, while species diversity was more uniform.

The two Manatee River segments exhibited a greater species similarity to each other than to the Little Manatee River segment. Lack of marked temporal change in the periphyton community was ecologically significant in delineating the Little Manatee River segment.

The aquatic environs at the Duette Mine site appears to be a detrital based system (heterotrophic). Characteristics of the periphyton community (e.g. dominance, density, species richness, etc.) appear to reflect the natural state of such a system.

Benthos: As previously noted the aquatic environment is generally devoid of benthic macrophytes. Benthic macroinvertebrate communities are characterized by dominance by few species, abundance of detrital feeders (scavengers and omnivores), abundance of "clean" water species, moderate density and biomass, and high species richness and diversity. Overall, the benthic communities appear to be characteristic of "clean" (sensu Beck, 1954; 1955) water conditions of a detrital based system. Substrate and seasonal temperature differences do not appear to alter substantially the benthic community structure at the study area.

Fish Communities: The fish populations are typical of Barnett's (1972) Narrow Streamlet Habitat. The dominant species are spotted sunfish and largemouth bass. Both fish are predators, the sunfish preying on small fish and invertebrates while the bass feeds on larger fish and invertebrates. The low density of smaller fishes is probably due to the lack of cover which makes them more available to the predators.

Impact

Table 4.12-A compares the acreages of the present natural communities and those that will survive mining operations or be restored by reclamation.

Land - The direct effect of mining will be the physical destruction of much of the present natural vegetation by land clearing/mining activity. The longleaf pine-xeric oak community will be eliminated on-site while the sand pine scrub community, longleaf pine-xeric oak community, and longleaf pine flatwoods community will be partially eliminated (Table 4.12-A). An overall 85% loss of native upland vegetation represents the magnitude of mining effects.

Table 4.12-A Acreages Before Mining and After Reclamation(1)

	Present Acreages	Acreages After Reclamation
Sand Pine Scrub (2)	73	50
Longleaf Pine-Xeric Oak	35	0
Xeric Oak (2)	518	89
Longleaf Pine Flatwoods (2)	5,673	829
Fresh Water Swamp (3)	1,219	1,228
Fresh Water Marsh (4)	600	864
Cypress Swamp (2)	18	18
Improved Pasture	1,677	6,642
Row Crops	468	107
Orange Groves	113	25
Mixed Forest	0	58
Lakes	0	384
Abandoned Mining Operations	0	100
	10,394	10,394

(1) Data from Swift Agricultural Chemical Corp. (1978: DRI/ADA No. 770861 and Addendum).

(2) Acreages after reclamation represent unmined lands that still contain the vegetation present before the commencement of mining operations.

(3) 476 acres of natural vegetation lost, mostly from along tributary creeks and bayheads, also from along 4,000 feet of the East Fork Manatee River which will be mined. Fifty-five acres will be recreated by planting saplings of native species at a density of 60 saplings per acre along the recreated East Fork Manatee River.

(4) 364 acres of natural vegetation will be lost from mining. Some additional acreages will be disturbed or lost from construction of roads, railroads, pipelines, powerlines, and from the crossings of draglines.

It is expected that these effects are largely long-term and irreversible. There are no known instance of these upland communities naturally re-establishing and fully recovering if the soil is radically disturbed. Various authors have assumed that these communities represent seral stages, but development of these communities has not been reported. Some of the dominant species readily invade disturbed sites but others (e.g., wiregrass) have negligible reproductive potentials. Reclamation is designed to replace most natural land communities with improved pasture, thereby largely precluding the re-establishment of the original vegetation, even if it were biologically possible to do so.

Not all sites containing native upland communities will be mined. The remnants of upland vegetation will primarily be small and isolated between swamps and/or improved pastures. Since the natural upland vegetation is dependent on fire for its maintenance, and since fires will likely be excluded from the surrounding swamps and pastures, prolonged fire supression will constitute a long-term or even irreversible impact.

The significance of mining will be a substantial loss of natural upland habitat and a substantial gain in improved pasture. Timber values are presently small. What little is lost by mining may be offset somewhat by planting pines in understocked pine flatwoods that are not scheduled to be mined. An indirect effect of mining will be that on animal populations which presently depend on the natural upland vegetation in areas to be mined. Animal use is relatively low, as was previously noted. Deer, feral hogs, and other larger animals will move into suitable habitats nearby during mining operations. Most suitable habitats are probably understocked, owing to hunting which is an important form of recreation in the region. Mice and other small animals will be less likely to escape and will suffer major reductions in their populations. Some of these smaller species likely will adapt to the habitats created by reclamation.

Some acreages containing natural communities are not scheduled for mining but may be affected by related activities. These activities include the "walking" of draglines between mine sites and the construction of roads, railroads, pipelines, and transmission lines. The magnitude of these activities has been estimated for the uplands at 60-65 acres. Any major disturbance will be a long-term negative impact as no reclamation or other mitigative measures are proposed.

During mining, the ground-water table will be lowered beneath nearby natural communities which are not scheduled for mining. The water tables will be restored in less than two years as the mined-out pits are filled during reclamation. Water tables are expected to closely approximate their pre-mining levels thereafter. The magnitude of dewatering would be equivalent to that of severe drought. If rainfall is above normal and frequent throughout the growing season, the lowered water table may have little or no effect on the maintained vegetation. If rainfall is subnormal or irregular, vegetational production (biomass) will be reduced, and some plants may remain dormant for a year or more. Normal growth would be expected to resume as soon as normal water tables are attained, just as growth resumes without ill effect after severe natural drought. This short-term effect may even be less detrimental to animals than to plants. Many animals would adjust by moving a short distance to adjacent areas where more mesic conditions prevailed.

Levels of dust and other emissions will increase during mining operations. Other than radioactive nuclides which are treated in another section, the only component of these emissions of potential impact to plants and animals is fluoride. Fluoride varies in degree with the species, the fluoride concentration, and the chemical form of the fluoride. Gaseous fluoride compounds may be generated during mining operations in minor quantites from the dryers. The high rainfall in the region will cleanse the vegetation of rock phosphate dust at frequent intervals, thereby reducing the potential for fluoride toxicity. Studies in Polk County (Environmental Protection Agency, 1978) showed that vegetative fluoride content varied with the amount of rainfall, demonstrating this cleansing effect. After entering the soil, fluorides are scarcely if at all absorbed by roots. Fluoride emissions apparently will constitute a short-term, low magnitude impact that will cease upon the completion of mining operations without residual effects.

Other emissions, including SO_2 and radionuclides, will occur at such low levels as to constitute no discernible impact on the biota.

Land-Water Interface - Mining will destroy 476 acres of fresh water swamps and 364 acres of fresh water marshes. The 18-acre cypress swamp will be unaffected (Table 4.12-A). Reclamatin is planned to restore these acreages and contribute others for a net gain of 15%.

The regrowth of fresh water swamps will be slow. Several decades of tree growth are necessary before a mature forest develops. Tree establishment might be delayed in places because of unanticipated problems in stabilizing the substrate of the restored flood plain. Full stocking may be delayed because of the intangibles associated with the natural dispersal of seeds and other propagules from undisturbed flood plains nearby. The initial forest cover likely will resemble that presently occurring on the flood plains of the major streams, rather than those of bayheads. Sweetbay, swamp bay, and other species that are more common in bayheads will likely remain relatively uncommon until peaty acid substrates gradually develop along the minor tributaries.

Fresh water marsh restoration should be more rapid. Emergent and shallowly submerged aquatics readily invade borrow pits, clay settling ponds, and other newly created wet habitats in the region. It is likely that cattails will become dominant, perhaps to the exclusion of all other emergent species. This effect would occur in the littoral zones of newly created lakes but would be more pronounced in the swales and marshes that will be formed by subsidence at the outlet ends of sand-clay land fills. Once established, dense growths of pure cattails may persist indefinitely. as long as water levels are seasonally deep enough to exclude seedlings of willow, buttonbush, and other woody plants.

Animal populations closely associated with the shallow marshes will be reduced initially as a result of mining, corresponding with the on-going loss of habitat and the activity inherent with mining operations. As marsh restoration will also be on-going as part of land reclamation, most or all of these populations should return to pre-mining levels upon the recreation of wetlands habitats, assuming no interference from cattails.

In summary, the effect of mining on marshes will be short-term with regard to the rapidity of marsh re-establishment on reclaimed lands. The probability of cattails predominating in much of the reclaimed marshland may constitute a long-term adverse impact of low magnitude with regard to species diversity and wildlife utilization. This impact would not be adverse with regard to water quality and flow.

Pipelines, transmission lines, roads, and other structures that may be built across 15-20 acres of wetlands not scheduled for mining will create a disruptive influence on the vegetation. These disturbances will be short-term in places and long-term elsewhere. Unlike in the uplands, swamp and marsh vegetation has the capacity to establish itself readily after stable substrates and suitable hydroperiods are attained.

Pit dewatering during actual mining will lower the water table beneath nearby natural swamps and marshes that are not scheduled for mining. Plans call for mining one side of a floodplain at a time, thereby depressing water tables minimally. Reclamation immediately following mining will allow the restoration of previous ground-water levels. During dewatering, the lowered water table may have the same effect as a prolonged natural drought. The vegetation will be stressed, especially if rainfall is subnormal during the growing season. Nonetheless, these conditions occur naturally about every two decades without long-term harm to the native vegetation.

An indirect effect of dewatering would be to increase the possibility of wildfire in swamps. Ignition could result from lightning or from carelessness during mining operations. Such fires would have no appreciable adverse effect on any of the land or land-water interface vegetation except for the fresh water swamps. Fire-tender hardwoods could be killed over wide areas. Cypress trees are fire-tolerant and would be unaffected, unless a ground fire develops in the peat. The possibility of widespread fire is remote, particularly since it would be unable to spread across the many roads, mining pits and other clearings devoid of fuel. Further, the likelihood of ignition of a swamp is unlikely in years of normal rainfall.

Fugitive dust and other emissions might possibly have an adverse impact. The comments on dust and emissions in regard to the land communities apply equally to those of the land-water interface.

Water - Various mining activities will result in the destruction, alteration, and/or restoration of aquatic habitats as well as the creation of new habitats. Among the new habitats will be several large lakes, a type of habitat not presently existing in the vicinity of the mine site.

The direct impact of mining will be the complete destruction of some aquatic habitats, primarily small, intermittent tributaries. The magnitude of this effect is measured by the loss of 417 acres of ephemeral feeder streams and their floodplains. In addition, plans call for mining of approximately 4,000 ft. of the East Fork of the Manatee River, one of the major streams on-site.

Mining of the streams will result in the destruction of many of the indigenous animals, although some, especially the fishes, will be able to flee to adjacent undisturbed areas. Even so, this does not assure their survival. Populations in the adjacent areas are probably already at their carrying capacities and increases in their populations would be countered by increases in predation and disease and a decrease in reproduction. When populations had again stabilized, the densities of animals would approximate levels present prior to mining. Thus, there would be a net decrease in numbers proportional to the decrease in habitat.

An indirect effect of mining operations will result from the projected short-term loss of adjacent floodplain forest. This will result in a decrease in the amount of detrital input to the aquatic system. The streams on the site are highly heterotrophic. Detritus from the fresh water swamps is an important source of energy to the streams, the reduction of which will result in a reduction in the carrying capacity downstream. Swift proposed restoring the mined section of the East Fork and 430 acres of the tributaries. The effect of the restoration is discussed later.

The streams will be crossed at several points by pipelines, permanent and temporary roads, power lines, and a railroad. The draglines will be "walked" across the streams several times. These activities not only result in the destruction of small areas (totaling approximately 15-20 acres) but can also alter the character of the streams for considerable distances downstream.

One effect of these activities near and across the streams is to open the flood plain forest canopy, allowing more sunlight to reach the water. At the present time, the shade from the forest canopy severely limits the growth of aquatic plants. Where breaks in the canopy now occur, there are dense growths of emergent and submerged macrophytes, especially alligator weed, Alternanthera philoxeroides ; pondweed, Potamogeton diversifoliua ; spatterdock, Nuphar luteum ; and stonewart, Nitella sp. These species will expand their populations wherever the canopy is broken. Periphyton will increase because of the increased light and the increase in substrate provided by the aquatic macrophytes.

The change will have a positive net impact on small fishes and invertebrates. The macrophytes will provide shelter from predation for insect larvae, crayfish, grass shrimp, and small fishes, allowing them to attain higher densities than in areas devoid of plants. In addition, the periphyton will be an additional source of food for many of these species. The changes will be long-term but will be reversed when new tree growth closes the openings in the canopy (15-20 years).

The increased sunlight reaching the water will also cause a rise in water temperature (Burns, 1972). The change is not expected to be of a magnitude which will significantly effect any of the species now present.

An indirect effect of the stream crossings is an expected increase of erosion. Erosion runoff can cause serious short-term negative impacts largely due to the suspended solids carried by the runoff water. Suspended solids damage aquatic communities by reducing light penetration (thus reducing photosynthetic activity), smothering benthic organisms, destroying spawning areas, and abrading and clogging the gills of fishes (Bennett, 1970; Cairns, Lanza and Parker, 1972; Lackey, 1975). The effects of erosion are quickly reversed following abatement. Barton (1977) reported that erosion from highway construction increased sediment deposition in a nearby stream ten-fold, while suspended solids increased more than two hundred-fold. This resulted in a reduction in the standing crop of fishes immediately below the construction site by more than half. No effects were detected further downstream, however, and population levels at the construction site returned to normal within eight months.

Little disruption of the flow in the streams is expected due to mine pit dewatering (Ardaman & Associates, Inc., 1975), hence there will be little impact on the aquatic biota.

Discharges into the North and East Forks from the water recirculating system may contain a number of substances which may have subtle impacts on the aquatic biota. Potential pollutants include clay wastes, phosphate, flotation reagents, and sewage effluents. Water samples collected at Swift Agricultural Chemical Corporation's Silver City Mine (CCI, 1978) showed elevated concentrations of phosphate, ammonia, dissolved solids, fluorides, and zinc. With the exception of ammonia, the Silver City Mine effluent may be considered representative of the nature of discharge expected.

Ammonia, fluorides, and zinc are toxic in varying degrees to aquatic organisms (Cairns, Lanza, and Parker, 1972; McKim et al., 1976; Herricks and Buikema, 1977). The toxicity of each varies from species to species, but prolonged elevation of concentrations of these chemicals in the streams would lead to a long-term reduction in the diversity of the biota. The infrequent planned discharges of these chemicals at concentrations comparable to the Silver City Mine effluents should result in minor short-term impacts.

Ammonia and phosphate are plant nutrients. Phosphorus and nitrogen have been identified as the primary nutrients contributing to eutrophication (Brezonik et al., 1969). However, rivers draining this area of Florida naturally have high phosphorus levels (Dragovich and May, 1962; Dragovich, Kelly and Goodell, 1968). Nitrogen levels in this area are normally low (Dragovich and May, 1962) so that the lack of nitrogen may be limiting to the rate of eutrophication. Eutrophication is a long-term negative impact which is not readily reversed. It usually results in shifts in species composition toward nuisance species and a reduction of diversity.

Phosphate mining will create several lakes on the Swift site. This is a significant expansion of the aquatic environment and can be considered a positive impact of mining. Lakes created by phosphate mines are known to support sizable fish populations (Crittenden, 1965). Species which now occur on the site and which may be expected to expand into this habitat include the Florida gar, golden shiner, lake chubsucker, brown bullhead, mosquitofish, bluegill, largemouth bass, crayfish, grass shrimp and many of the insect larvae.

The segment of the East Fork of the Manatee River and 430 acres of the intermittent streams which are to be mined will be restored. The native fauna should rapidly recolonize this area since aquatic invertebrates (Williams and Hynes, 1977; Chisholm and Down, 1978; Kaster and Jacobi, 1978) and fishes (Gunning and Berra, 1969; Berra and Gunning, 1970) have been observed to recover rapidly in other disrupted streams. Initially, the flood plain forest will be poorly developed, resulting in small detrital inputs and high light intensity. Until the forest canopy becomes well established, aquatic macrophytes and periphyton communities will be well developed. These communities will decline as the shading from the forest canopy increases. Eventually, the restored stream segment should be representative of a natural stream.

Mitigating Measures

The mining and reclamation plan incorporates several structural and nonstructural measures intended as safeguards for the environment and biota of the site. These safeguards are treated below under three headings: planned preservation areas, safeguards during mining, and reclamation benefits.

Planned Preservation Areas - Significant mitigating measures associated with the proposed activity are related to the mine planning effort of the applicant. Natural vegetation considered sensitive or unique was specifically identified, ranked, and mapped prior to formulation of the mine plan. Associations marked for prime consideration by the mine planners included the sole cypress stand of the site (18 acres), two stands of sand pine scrub (23 and 50 acres), and the entire floodplains of major streams, as identified by the dominant vegetation.

As proposed in the mine plan of the applicant, the cypress stand is entirely excluded from the mining plan, as is the larger stand of sand pine scrub. The wooded floodplains of the major streams are also excluded with the exception of a three-quarter mile segment of the East Fork Manatee River which is proposed for mining and subsequent reclamation as a swamp.

In addition to preservation of the above described areas, the environmental value of 829 acres of pine flatwoods not scheduled for mining will be improved. These flatwoods remained understocked with pines ever since the original timber harvest several decades ago. Seedling pines will be planted at a density of 100 per acre in an attempt to re-establish the original forest cover.

Safeguards During Mining - The quantity of fugitive dust that could settle on the vegetation in the vicinity of mining operations will be reduced by spraying water regularly on the well traveled roads. Air emissions will be kept within applicable standards further protecting the biota that is not disturbed or destroyed by mining.

Exposed soils of reclamation areas will be planted with cover crops as soon as possible to prevent erosion and consequent sedimentation in streams.

In-system water recycling and the attendent minimization of water discharges from the plant and settling pond will reduce the potential for water pollution both on-site and elsewhere. If excessive water accumulates after exceptional rainfall events, this excess will be diverted into clarification ponds before it is released into natural streams. Water quality will be monitored daily at permanent stations to insure that discharges into streams meet applicable standards.

In an effort to protect wetlands along streams, the mine plan incorporates active mining along only one side of a wetland at a time. The mine pit will be filled before the other side is mined. As a result, the base flow of ground water into these wetlands will never be severed entirely and the potential for the wetland vegetation suffering from water-stress during mining will be reduced.

Mining will not take place within 200 feet of any retained flood-plain. As a result, base flow into streams will be maintained at near normal levels even on the side of a stream being mined. On the long-term, it is estimated that base flow that enters streams will be reduced by no more than 1.5% after reclamation.

The possibility of leakage from pipelines crossing natural streams will be reduced by the use of retention dikes at the outer edges of flood plains and by the construction of double walled, trestled pipelines over floodplains. If leakage should occur, it will be detected quickly by an alarm system that is activated with a change in pressure in the pipeline.

The mining of the East Fork Manatee River will be mitigated by the prior diversion of stream flow through a newly created meandering stream bed and 55 acres of flood plain. This new floodplain will have been planted initially to grasses for soil stabilization and then to native bottomland hardwood trees, with hopes of speeding forest development. There will be no mining upstream until the new channel has been properly established. As a result, water quality downstreams will be not be degraded.

Reclamation Benefits - All reclaimed land will be revegetated to minimize erosion. Physical land restoration will be completed within three years after the inception of mining in a given area (one year for mining and two years to fill the mine pits with tailings or a sand-clay mix). Water tables will be re-established after reclamation. This effect will be immediate, because the pits will be filled by an aqueous slurry of tailings and sand-clay mix. As a result, the natural vegetation of surrounding unmined areas will not suffer prolonged water-stress, if any at all.

The sterile, excessively drained sand tailings fill areas will be spread with overburden or sand-clay mix, which have better soil characteristics allowing faster revegetation. Reclaimed lands will be planted to a sod of Bermuda grass, bahia, and white clover, which will promote the rapid incorporation of organic matter and thus the development of a top soil. Hedgerows of native trees will be planted on about 1% of this land, providing escape cover for wildlife. Patches of *Eucalyptus* will also be planted to serve as cattle shade.

The re-establishment of swamps and marshes is a major feature of the reclamation plan of the applicant. Fifty-five acres will be planted to native bottomland hardwoods at a density of 100 trees per acre in the reclaimed East Fork Manatee River after mining. Minor tributary creeks leading to the larger streams will largely be mined. They will be replaced by an additional 430 acres of reclaimed lands which will be planted to native bottomland hardwoods. The native marshes occurring in flatwoods depression that will be lost during mining will be replaced by similar depressions on reclaimed lands. These depressions will be allowed to revegetate naturally. There will be a net gain of nine acres of fresh water swamps and 264 acres of fresh water marshes after reclamation.

These marshes and swamps are to be located so that they may serve as clarification and nutrient filtration areas for runoff before entering the major streams. They also form a continuous network of native vegetation which will serve as corridors for wildlife. Mine pit lakes resulting from reclamation are integrated with these corridors.

Reclaimed lakes will contain a substantial littoral zone (approximately 10% of lake area) which will enhance their biological productivity. A 100 acre area adjacent to the northernmost reclamation lake will intentionally be left largely unreclaimed. The series of steep windrows of spoil will be topped and allowed to revegetate by natural means and in time will serve as roosting areas for water birds. The rugged terrain will discourage predators (and people) from disturbing these roosts.

Rare and Endangered Species

Several lists of endangerd species are in current use. Those which apply to the Swift mine site are the Endangered Species Act of 1973 (Code of Federal Regulations: Title 50, Chapter I, Part 17), Florida Game and Fresh Water Fish Commission (1976), and Florida Committee on Rare and Endangered Plants and Animals (1976). In addition, the Smithsonian Institution has prepared a list of plants which are proposed for inclusion in the Endangered Species Act list (U.S. Fish & Wildlife Service, 1976). Each list uses the term "endangered" for those species facing the greatest danger of extinction. "Threatened" is used for species in less danger. The Florida Committee on Rare and Endangered Plants and Animals adds the categories "rare" and "species of special concern".

All federally-listed and state-listed species that would be reasonably expected on the Swift property are listed in the Biology and Ecology Resource Document. A special effort was made during the field investigations to look for these species on the proposed mine site.

Sixteen endangered, threatened, rare, or special concern species have been observed on or immediately adjacent to the Swift property. Of the sixteen observed species listed, none were considered as endangered on the federal lists, but three were listed as threatened. They were: pinweed, eastern indigo snake, and American alligator.

Federally Recognized Species - The habitats for pinweed (sand pine scrub and xeric oak) will be reduced in area by mining operations. Since these habitats will not be restored by reclamation, pinweed populations will suffer a reduction through mining operations. The eastern indigo snake will decline in numbers with the destruction of swamps during mining but should recoup their former numbers after reclamation is completed. The alligator will decline somewhat during mining but will increase substantially above present population levels with the addition of 384 acres of lakes and a 15% increase in other wetlands when reclamation is completed.

State Recognized Species - Thirteen species sighted were recognized only on state lists. One was endangered (wood stork), five were threatened (gopher tortoise, southeastern American kestrel, Florida scrub jay, Florida sandhill crane, Sherman's fox squirrel), and seven were of special concern (common egret, Louisiana heron, black-crowned night heron, white ibis, little blue heron, burrowing owl and carracara).

Wood storks are sometimes seen in clay settling ponds and may increase their numbers on the property during mining operations as the proposed settling pond becomes available for their use. The swales, marshes, and wet pastures of the reclaimed land will likely attract them, assuring that present population levels are maintained or even increased.

The gopher tortoise will decline during mining operations but will regain or even exceed its former numbers following reclamation. These land turtles are common on formerly strip mined sites. The abundance of well drained slopes will favor their return on reclaimed lands.

The southeastern American kestrel will decline during mining operations. The probable lack of thickets in the vast expanses of improved pasture may prevent this hawk from regaining its present population size.

The Florida scrub jay may be driven off the property during mining operations. The likelihood of the return of this species is reduced because of the reduction in acreage of its scrub and xeric oak habitats.

Florida sandhill cranes will tend to move off the property during mining operations but will return in approximately their present numbers following the restoration of marshes and swales.

Sherman's fox squirrel may survive mining operations in the cypress swamp or other unmined habitats, although this possibility is not assured. If pine flatwoods are successfully restocked in the restoration effort, the fox squirrel may eventually become common on parts of the property.

The several wading birds listed by FCREPA (1976) as species of special concern. All should continue to utilize the wetlands of the property during mining operations. All may increase in numbers after reclamation because of the addition of lakes and the creation of marshes and swales.

Some other species that might utilize the site deserve further comment. Panther and bear are wide ranging animals that could pass through the Swift property in the fresh water swamp community along streams. They would likely be transient, because the surrounding uplands have been too greatly modified for their use. The red cockaded woodpecker lives nearby (Hirth and Marion, in press) but is not expected on the Swift property for lack of sufficient old-growth pines. In time nesting colonies might occur there, as long as the present pines are allowed to mature and if former pinelands are restocked.

The Florida mouse may occur in the pinelands but would have been overlooked, because traps for small mammals were not set. The gopher frog, which is a commensal living in the burrows of gopher tortoises, may also have been overlooked, because gopher burrows were not disturbed during the field investigations. The burrowing owl was seen a short distance away on adjacent property and may well frequent the Swift property.

Bald eagles, ospreys, and caracaras might make occasional visits to the Swift property, but the present complex of habitats would not be particularly attractive to these species. Additional details on the regional status of these animals are given by Layne et al. (1977).

Environmentally Sensitive Areas

Baseline - This section assigns environmental sensitivity values to the various attributes of each community/habitat. An area is considered sensitive if it meets one or more of the following criteria:

- o Contains endangered or threatened species which cannot survive elsewhere.
- o Fulfills an important function, such as aquifer recharge or high wildlife capacity.
- o Represents a unique or rare community or habitat in west-central Florida.

Twelve attributes were evaluated on a scale of 1 to 5 (Table 4.12-B). Other potential attributes were omitted because they do not represent land uses (e.g., camping, hiking) or natural processes currently associated with the Swift property. The assignments of some values were necessarily subjective for lack of sufficient observations or data.

Table 4.12-B Environmental Values

Habitat	Grazing	Endangered Species Habitat	Vertebrate Production	Timber	Fishing	Hunting	Aesthetics	Water Storage	Aquifer Recharge	Water Quality	Erosion Control	Fire Break
Row Crops	5	4	3	3	3	2	5	4	3	5	4	1
Citrus	5	5	5	3	3	3	4	4	3	5	5	1
Improved Patures	1	3	3	3	3	3	5	2	3	4	4	4
Sand Pine Scrub	3	1	3	3	3	3	1	2	3	2	1	2
Xeric Oak	3	1	3	3	3	3	2	2	3	2	1	2
Pine Flatwoods	2	2	2	3	3	2	2	2	3	2	1	5
Marsh	1	2	1	3	3	2	1.5	2.5	3	2	1	5
Swamp	3	2	1	2	3	1	1	3	3	2	2	1
Cypress	3	2	1	2	3	2	1	1.5	3	2	1	2
Lake*	4	1	1	5	1	2	2	1.5	3	3	4	1
Wilderness*	5	2	2	5	3	3	4	2	3	4	5	3.5
Mixed Forest*	2	4	2.5	1	3	2	2.5	2	3	2	2	4
Stream	3	3	2	3	2	1	1	3	3	3	5	5

* Habitat to be created by reclamation and not part of the present landscape.

Values:
1 - High positive value
2 - Low positive value
3 - Neutral; without effect with regard to the attribute
4 - Low negative value
5 - High negative value

Only those assigned values in Table 4.12-B that are not self-evident are discussed below.

Water Storage: Wetlands are generally considered prime water storage areas during dry seasons. Streams are exceptions, because they export water when the water table is above the level of the streambed. In the region of the proposed mine, the water of marshes and hardwood swamps is probably the result of base flow of the groundwater from adjacent areas. The water table of wetlands is exposed and, therefore, subjected to loss through evapotranspiration. Such a loss in water is not characteristic of the adjacent uplands, because soil water does not rise through the sands to the surface by capillarity (Woods, 1957) and because the feeder roots (responsible for water absorption) are nearly all superficial.

Cypress swamps may be exceptional because the shade from cypress trees reduces evaporation from the pond surface (Odum, 1976), and perhaps because water absorption and thus transpiration are reduced by the high acidity of cypress ponds. The values in Table 4.12-B reflect these considerations.

Aquifer Recharge: Table 4.12-B shows a neutral value of 3 for all communities, because available evidence indicates that there is minimal recharge occurring on the proposed mine site (Ardaman & Associates, Inc., 1975). Recharge of the confined Floridan aquifer sometimes occurs only at remote localities within a large region (William F. Guyton & Associates, 1976). Most cypress heads in peninsular Florida are underlain by confining beds of clay which prevented recharge of the Floridan aquifer (Ewel, 1976).

Water Quality: Water quality values were assigned on the basis of potability. The soils of natural communities do not degrade water quality and may improve it by the absorption of ions to their colloidal surfaces. The stream is considered neutral. Heterotrophic metabolism likely results in the mineralization of nutrients which go into solution, degrading water quality. This effect may be slight because of the low metabolic rates in streams and may be offset by the oxygen added by agitation of the flowing water.

Erosion Control: Erosion is a continual process in flowing streams. Streams are given high negative values for erosion control, accordingly. Natural communities are characterized either by standing water or by dense superficial root mats that bind the soil. These are given high positive values for erosion control. Freshwater swamps are exceptions over long time spans, because colluvial transport occurs and gradually enlarges valleys. Improved pastures are likely subject to some erosion due to a less effective root mat than in natural communities and to soil exposure caused by trampling.

Vertebrate Production: The values for this attribute are indicative of the relative biomass of all non-domestic vertebrate animals.

On the basis of the environmental values in Table 4.12-B, the environmental sensitivity of the existing communities/habitats can be judged. A community/habitat is sensitive if it contains rare and endangered species that are unable to survive and reproduce in any other kind of habitat, if it fulfills an important function or beneficial "service", or if it is unique or rare in west-central Florida.

Rare and Endangered Species: None of the habitats at the proposed mine site can be identified as being particularly sensitive on the basis of the rare and endangered species seen in them.

Fulfillment of an Important Function: Table 4.12-B shows that each community performs some beneficial "services". No community or communities stand out as being far superior to the others, and none are particularly inferior. A reason for this apparent equity is that the properties that combine to make a community superior for one function may make that community inferior for another function.

The destruction of a swamp forest has a profound effect on water quality downstream, on aquatic communities in the streams, and on populations of terrestrial animals that primarily inhabit other communities. These and other negative impacts caused by the destruction of swamps are listed in the regulations pertaining to Section 404 of the Federal Water Pollution Control Act, published July 19, 1974 (Federal Register 42(138: 37136).

For these reasons, the fresh water swamp community is designated as environmentally sensitive.

Unique or Rare Communities: The sand pine scrub community is the only community on the Swift property that is not particularly abundant in west-central Florida. It occurs only in Florida and in one adjacent county in Alabama. It is distributed irregularly and often in small stands. Many or most of these stands have been destroyed and the sites converted to citrus groves or urban developments. Some of the component species aggressively invade culturally disturbed sites, but active seral development that leads to the establishment of the entire community has not been observed. Present evidence suggests that the community is relictual and that its destruction constitutes an irretrievable loss of habitat.

The sand pine scrub community may be considered to be marginally sensitive and will become more so as future land use impinges on its habitat.

Impacts - It was assumed that there would be no change in environmental values after mining and reclamation for a given community/habitat. The values in Table 4.12-B assume that values are similar for a re-established site as for the present conditions. It is questionable, though, as to whether or not the swamps and marshes that will be created on mined and reclaimed lands will have the same environmental values that were assigned to natural swamps and marshes. Natural habitat restoration as proposed for the Swift site has not been attempted previously. Prototypical studies are being initiated on some mined lands in central Florida, but the results are not yet available. It would be improbable that the restored marshes would have the exact species composition and dominance patterns as in natural marshes, at least initially.

Cattails were absent on the natural marshes studied on the Swift property (Biology and Ecology Resource Document), but they dominate the marshes of abandoned clay settling ponds throughout the Central Florida phosphate district. Since cattails aggressively invade ditches, reservoirs, and other newly created wet sites with mineral substrates, it is possible that they will be important in the newly created marshes on the sandclay fills proposed for the Swift property.

Since there is no method of determining with confidence the environmental values of newly created swamps and marshes on reclaimed lands, it was assumed that the environmental values of natural habitats are coincidental with those of recreated habitats.

Lakes: The emergent and shallow submerged aquatic plants of the littoral zone will be utilized by cattle, thus a grazing value is appropriate, although lower than that of the improved pastures that these lakes replaced. Lakes will attract wood storks, the large wading birds of special concern, alligators, perhaps eagles, and other rare and endangered species. The biomass of fish and reptiles and their high turnover rates contribute to high vertebrate productivity. The timber value is rated low, rather than neutral, because presently wooded habitat is being replaced by lakes. The water storage value is better than that of swamps and marshes because of a better surface-to-volume ratio, less emergent aquatic vegetation that promotes transpirational losses, and probably a partial cover of water hyacinths that will reduce evaporation. The banks will be subject to wave action, causing some erosion.

Wilderness Area: The wilderness area will consist of spoil piles which will be allowed to become revegetated by natural means. The vegetation of similar sites throughout the central Florida phosphate district consists of woodlands which do not closely resemble any indigenous plant communities in structure or species composition.

Gross production will be relatively low because of the sparse growth of brushy vegetation that will occupy these slopes for at least several decades. The steepness of the slopes will retard the establishment of more luxuriant vegetation. This vegetation will have a low aesthetic value. The angle of slope will cause continual erosion in wet seasons. Vertebrate production may be high, either from nesting birds attracted to the lake and partially isolated from predators, or from rodents that are also partially isolated from predators.

Mixed Forest: The values for this habitat are about the same as those for other wooded habitats. The value for grazing is high and that of fire break capacity low, assuming incomplete canopy closure and a grassy undergrowth.

Mitigation - Not all areas of the property will be mined or irrevocably disturbed. Approximately 761 acres of floodplain swamps will be spared from mining and will be preserved without modification. Fifty acres of sand pine scrub and the 18-acre cypress pond will also be preserved. Normal water tables will be resumed shortly after mining, thereby minimizing the period of stress and the resultant loss of plant life from desiccation. The use of a sand-clay mix in reclaimed sites should create soils that are more fertile and have a higher water retention than the natural soils. As a result, improved pastures on the reclaimed lands may have higher yields than at present.

There will be a net increase of swamp forests and marshes after reclamation assuming proposed reclamation technologies are successful. The swamps will be planted and the marshes will be allowed to develop naturally on reclaimed land. As noted above, it is unknown whether or not the swamps and marshes on reclaimed land will have as high a value as they presently have.

The lakes created by mining will have positive environmental attributes. Their wide littoral zones will enhance their potential for high biological productivity.

5.0 DESCRIPTION OF BASELINE, IMPACTS AND MITIGATING MEASURES OF THE MANMADE ENVIRONMENT

5.1 DEMOGRAPHY

Baseline

Number of Inhabitants - Regional - The U.S. Census Bureau announced in 1976, that for the first time in United States history, the majority of the population resided in the south and west. This growth is primarily a result of migration out of the north and into the "Sunbelt".

Florida has been a primary recipient of this immigration for several decades. During 1970-77 the state's population grew from 6.7 million to an estimated 8.7 million, a gain of 28% according to the Florida Statistical Abstract.

The migration of new residents into the state is primarily a result of climatic and other natural features. In addition to this historic trend of retiree orientation, Florida is also witnessing an increase of the younger immigrant seeking work or being given the opportunity to relocate because his employer is establishing Florida facilities.

For numerical analysis of Florida's population in the area centered around the phosphate industry, this survey will make use of demographic statistics reported in the Areawide Central Florida Phosphate Industry Environmental Impact Statement (Areawide EIS) recently prepared by EPA for the Council on Environmental Quality. The seven counties included in the Areawide EIS are Charlotte, DeSoto, Hardee, Hillsborough, Manatee, Polk, and Sarasota.

Nineteen Seventy-Seven estimates for Florida indicate that the 7-County total is 1,261,868, a seven year gain of 27.4%. The region accounts for 14.5% of the total 1977 Florida population of 8,717,334. It also accounted for 14.1% of the state's estimated population increase during the period 1970-77.

Future projections of regional population for the year 2000 range from a low of 1.7 million to a high of 2.2 million.

This forecast increase in population can be easily assimulated in the developed urban areas that presently exist within the 7-county region. Urban areas where future growth may be expected to locate are further discussed in Section 5.3 Land Use.

Number of Inhabitants - Manatee County - The county had a 1970 population of 97,115, a 40% gain over 1960. Manatee County had a 1975 population of 123,506, a 27% gain over the 1970 Census count. The 1977 figure was 129,313.

Migration has been the primary cause of county growth over the past four decades and there is no reason for this to change in the near future. The county will be connected to the interstate system within five years, several major industrial firms are building large plants in the county resulting in some 2000 new manufacturing jobs, and the historic factor of retirees locating on the Florida Gulf coast is expected to continue.

Future population of Manatee County is projected to nearly double during the period 1975 to 2000, going from 123,500 to 241,600 according to University of Florida estimates. U.S. Department of Commerce projection for the year 2000 number 253,600 and the Tampa Bay Regional Planning Council figure is 291,823.

Age : The age of inhabitants is a useful indicator of socioeconomic patterns. The older resident has long been a major factor of Florida population trends. Few of the State's 67 counties are similar to the national pattern. This is a result of retiree migration to the state. Only Hillsborough in the 7-county region approximates the 1970 median age for the nation of 28.0. Manatee County is representative of many of Florida's retiree population centers. At the time of the 1970 census nearly one third of its residents were over age 65. The county's median age was 48.7.

The aging trend of many Florida counties can be expected to continue as the retiree migration continues. Factors that may lower average age characteristics in selected areas include: increased industrialization or major tourism facilities which will attract a younger labor force, and continued expansion of service and retail employment opportunities for existing residents allowing them to stay rather than relocate because of the lack of job opportunities.

Employment - The region with a population of 1.2 million has a labor force estimated at 531,500 or equal to 45% of its residents, thus counting some 493,000 persons working in mid-1977. Unemployment rates range from 5-7% for each of the seven counties in the region.

The region's employment base is quite diversified, with agriculture, food processing, light and heavy industry, retailing and services located in the interior counties. The coastal areas contain resort and leisure services, retailing as well as all levels of industry and manufacturing, residential construction (a major factor in unemployment during periods of recession), and substantial numbers of workers in communications, government, transportation and utilities.

Impact

Region - Population characteristics and projected growth for the 7-county region should not be impacted by the planned Duette mining operation. It is an extension of general mining activities within the industry and is a replacement for an existing Swift facility.

The location of the new mining operation is in a rural location and will not disrupt any urban activities or development within the region. Support facilities are located in Hillsborough and

Polk counties to the north and can readily serve the Duette site.

During construction phases, it is generally quite easy to attract workers who are skilled in assembling industrial facilities from within the greater Lakeland-Tampa industrial work force. The actual number is under 500 and only for a short period.

Operation of the new Duette mine will require 324 workers according to the DRI Application. Many of these will be relocated Swift employees. A certain amount can be expected from other mines and also from the local Manatee labor force.

Manatee County - The local situation is similar to the brief Regional analysis. Needed mine workers should be easily obtained from the local labor supply. Support workers serving the mine operation may reside in Manatee but in small numbers.

The local labor force numbered 55,000 according to March, 1979, state figures. As county population grows over the next 25 years so will its employee base. Other new industries locating in Manatee during 1979-81 may suffer a tight labor market for production and manufacturing skills but these conditions are believed different from the needs projected by the Swift operation.

Mitigating Measures

The proposed mine will not yield adverse demographic impacts that will require mitigation.

5.2 ECONOMICS

An important feature of the regional economy is its diversity. Within this 7-county region are: beach resorts, celery farming, cattle ranching, citrus groves, deep water seaports, shipyards, an international airport, wholesale warehousing, a steel mill, breweries, and distilleries, small and large manufacturing facilities, several universities, a medical school, towns of under 3,000 population and a metro city of nearly half a million.

Baseline

Of the seven counties making up the central Florida phosphate region in the Areawide study, three currently now have phosphate mining activity with two more planning for such activity. Charlotte and Sarasota counties were included in the Areawide study because they adjoin phosphate operations and may become impacted by changes in air quality, ground-water consumption and accidental discharges of waste water into a major river and estuary system.

In Central Florida, the phosphate industry employs some 8,000 workers with a payroll of over $110 million and pays nearly $10 million in property taxes.

Income Levels and Distribution - Florida ranks 26th in the nation in per capita income, but leads all southeastern states. Only Sarasota County exceeds the national average; the other counties fall between 70-80% of that figure. Sarasota stands out as a result of a high incidence of wealthy retirees and resultant transfer of income payments from other sources, rather than local employment dollars, as it is also a retail/service oriented community.

Employment - Within the 7-county region, labor participation runs from as low as 26.9% in Charlotte (a retiree center, median age of 62 is highest in the state) to 43.0% in Hillsborough (a youthful commerce and industrial center). Manatee County is in the middle with a rate of 35%. Overall for the state, the figure is 37.9%.

Employment by industry grouping reveals the various elements of the economy found within the 7-county region. Table 5.2-A summarizes regional employment by industry.

Table 5.2-A Regional Employment by Industry, 1970 and 1975

SIC		1970	1975
01-09	Agriculture, Forestry, Fishing	2.5%	1.5%
10-14	Mining	1.4	1.2
15-17	Construction	7.4	7.8
20-39	Manufacturing	17.6	13.7
40-49	Transportation, Communications, Electric, Gas & Sanitary Services	6.4	6.4
50-59	Wholesale and Retail Trade	26.4	27.7
60-67	Finance, Insurance & Real Estate	5.2	6.1
70-89	Services and Miscellaneous	15.5	18.6
90-97	Government	17.6	17.0
		100.0%	100.0%

Source: Planning/Marketing Services, Inc.

A picture of the regional labor force is given in Table 5.2-B. It now numbers over half a million out of the 1.2 million total population. Unemployment, not seasonally adjusted, was 7.1% in 1977. In December, 1978 it was estimated to be 5.8% , nearly equal to the U.S. Figure of 5.9%.

Table 5.2-B Civilian Labor Force, 1977 - 7-County Region

	Population (July, 1977)	Labor Force (March, 1977)		Unemployment (March, 1977)
		#	% pop.	
Charlotte	44,313	12,834	29.0	7.2%
DeSoto	17,973	5,485	30.5	6.8
Hardee	17,407	7,042	40.5	4.5
Hillsborough	602,667	280,338	46.5	7.6
Manatee	129,313	48,774	37.7	7.2
Polk	279,574	120,228	43.0	6.8
Sarasota	170,621	56,848	33.3	6.0
Region	1,261,868	532,549	42.1%	7.1%

Source: Florida Statistical Abstract 1977

Projection of the regional labor force over the next several decades is derived from previous population estimates.

Table 5.2-C Civilian Labor Force Projections, 1980-2000

		1980	1985	1990	2000
7-County Region	Population	1,461,600	1,654,900	1,827,200	2,152,200
	Labor Force	613,900	695,000	749,100	860,900
	%	42.0	42.0	41.0	40.0
Manatee County	Population	150,600	176,300	200,000	241,600
	Labor Force	57,900	67,000	75,000	89,400
	%	38.5	38.0	37.5	37.0

Source: University of Florida
Planning/Marketing Services, Inc.

In Table 5.2-C, both the region and Manatee County are downtrending in the percentage of the over age 16 population. In actual numbers over the period 1980-2000, the regional labor force will gain by 40.2% and Manatee by 54.4%.

Manatee County had total employment estimated at 52,300 in March 1979 from state figures. The unemployment rate was 4.9%, down from 6.0% in March 1978.

In Manatee County the worker/population ratio was 27% in 1960 and down to 22% in 1970 for non-agricultural employment. The county has long been a retiree community. This trend will continue but there is expected to be an increasing demand for major shopping facilities, new services, more utilities, government services and industrial expansion.

Future employment opportunities in Manatee County are primarily a continuing relationship with population gains. Only manufacturing or industrial development can occur without normal Florida growth. Manatee is unique, in that it has a deepwater port, large industrial zoned acreage tracts available, an interstate highway linkage to major markets and the Tampa Bay labor force.

Tax Structure - Property taxes are the primary source of revenue to local government in Florida making up 85% of local income, while the general sales tax is the richest income producer for the state, amounting to 42% of Florida revenues in FY 1976-77.

Other sources of revenue available to local government include; intergovernmental transfer of revenues, revenue sharing, fees and licenses, utility revenues, sales tax, resort tax, fines and interest.

The state obtains an additional 31% of its revenue from selective sales taxes; motor fuels, alcoholic beverages, tobacco products, paramutual wagering, etc. Another 11% comes from licenses. The remaining sources include: corporate income taxes, property taxes, document taxes, severance taxes and others.

Of primary interest are those governmental revenues collected from ad valorem and severance taxes.

Ad Valorem Taxes - Within the region, local property appraisers assess rural lands at the lowest possible value under the law. In most cases rangeland, or poor unimproved pasture, is valued at less than $70/acre.

For the Swift property, assessment is based on agricultural uses according to a 1971 agreement with the county. The 10,394 acre site in rural northeast Manatee County was assessed at $1,802,000 in FY 1978. This assessed value equaled $173/acre and was more than four times the assessed value of comparable unimproved rangeland surrounding the property. This agreement will probably continue until the land is permitted for mining or a different method of assessment is established.

Severance Taxes - Florida is one of 29 states that have this type of tax. The current rate of tax is levied at 10% with 25% of the proceeds available to the mining company for required reclamation operations. In 1976, the tax produced $9.8 million in revenues to the state at a 5% levy. The new taxing formula (1977) doubled the rate, but also increased the amount available to be returned to the mining company for reclamation. There is to be another change in 1980 to a levy of 8%. During the period 1971-77, the state collected some $59 million in severance taxes and refunded $24 million to mining companies for reclamation.

Other Taxes - In addition, the industry pays substantial sales taxes on the retail sales of the phosphate rock as feed stock to agricultural chemical products. Again sales taxes are paid on the purchase of operating supplies and materials. Sales tax revenues from the industry totaled $13.8 million in 1977 according to the Florida Phosphate Council.

Impact

The proposed Swift mining operation is intended to replace existing operations in Polk County with a new facility located in Manatee County. As the older mine ceases production, the new Duette Mine is planned to come on stream to maintain a continuous source of feedstock for Swift operations in Florida into the 21st century.

The proposed mining activity approximates a 30-year time period. This includes: site preparation, plant construction, mine operation and reclamation. Total expenditures for the proposed mining activity will approximate $647 million in capital and operating costs (Swift Agricultural Chemicals Corporation, 1978).

The following sections will address the economic impacts of the Swift mining operation on the Central Florida phosphate study region and also upon Manatee County. Costs and values are in constant 1978 dollars except where noted.

Direct Effects - Direct economic effects are measured relatively easily. They will be substantial outlays in capital and labor during construction and operation. The new Duette mining operation will have a stabilizing effect on the 7-county region as employment and expenditures are maintained for an additional ± 30 years. Without the facility, the region would suffer an opportunity loss as the existing operation ceases and Swift would be unable to replace the facility.

The proposed activity's impact on the regionl economy is small in scale. The region is projected to achieve a 1990 employment of 605,800 - the Duette mine 324 or equal to 3.2% of projected 1990 regional mining employment of 9,983. Annual production is estimated to be 3 million short tons per year - 6.7% of the projected regional figure of 44.8 million tons in 1990.

Local impacts are several. Polk County is going to lose its Swift mining operation as the ore body runs out. Manatee County can gain substantial tax advantages and possibly over 100 new jobs. It is assumed that over 200 workers will commute from the existing Swift labor force in Polk County. Non-use of the mine site would tend to retain the poor rangeland land uses in the eastern county with resultant lower tax payments to local government.

Local and state tax collections are also a direct effect of new economic activity. The new mining activity will create real property investment in Manatee County that will pay substantial local real estate taxes. Purchases of supplies and installation of new equipment are also taxable.

The following figures are the projected primary direct tax revenues to state and local government during mining operations:

	Annual Yield
Sales Tax (State)	
operating supplies & materials value - $9,561,000 x 4% =	$ 382,400
Severance Tax (State)	
Value to be set by Dept. of Revenue est. value - $16.00/short ton, tax rate (1980) 8% 25% of revenues - returned to mine for reclamation 25% of revenues - to Fla. phosphate Research Inst. 50% or revenues - to state general revenues production 3,000,000 T.P.Y. x $16.00 = $48,000,000 x 8% = $3,840,000 - 50% =	$1,920,000
Ad Valorem Tax (County)	
value of real estate and plant $120,947,400 x 16.388 mills =	$1,982,000

These are the primary revenue items to be analyzed. Additional taxable sources are included in the multipliers presented as indirect and induced effects on the region. Impacts on the national economy are beyond the scope of this work and have been presented in the recent Areawide study of the Central Florida phosphate industry.

The following additional direct effects to Manatee County should be measureable:

Agriculture - A small grove would be cleared, rangeland improved through reclamation for an annual gain in productivity of $250,400.

Housing - No housing will be displaced on the site. A portion of mining employment is expected to reside in Manatee County. Some will be relocating from Polk County, probably the majority will be current Manatee residents. New households could number 50, at an average home purchase of $40,000 each this could total $2 million in investments in the early years of operations.

Employment - An estimated 100 of the mine's 324 employees will reside in the county. Total payrolls and subcontractor labor costs are projected to total over $39 million over the life of the mine. The annual operating payroll for Manatee residents is approximately $1.5 million.

Business - Local wholesalers, servicemen and repair facilities should furnish a portion of the mines total maintenance and supply needs. This is estimated to amount to $1.8 million annually.

Government Services - The proposed activity should have only a light impact on typical local government services. It will absorb up to 100 local employees but with little impact or demand for public facilities such as roads, parks or schools. The mine operation itself is in a remote rural area and is self-sufficient in public utilities, security, fire and safety.

Local Taxes - The County tax base would increse greatly with the proposed activity. In 1976, the 10,394 acre site had an assessed value of $1.7 million and yielded ad valorem taxes of $28,137 at the rate of 16.388 mills to Manatee County according to the DRI Application. With capital improvements completed, the DRI estimates the following annual ad valorem tax yield during mining operations:

	Yield
6624 acres - mineable land @ $800/acre x 16.388 mills	$ 86,843
3769 acres - unmineable land @ $172/acre x 16.388 mills	10,624
Value of plant @ $115,000,000 x 16.388 mills	1,884,620
Total ad valorem tax yield per year	$1,982,087

Indirect/Induced Effects - The previous figures can be expanded to include the indirect and induced effects of the proposed activity through input/output analysis. The recent BOM study of the Economic Significance of the Florida Phosphate Industry, delineates interindustry multipliers that can be used to further illustrate impacts on the regional economy. It should be recognized that impact estimates are used to reveal magnitude and are not necessarily an accurate or precise measurement.

Based on projected mine production figures of 3 million short tons/year (2,720 million metric tons) and a $24.00/metric ton value at the mine, annual production could total some $65.3 million in sales (using constant 1978 dollars) or direct output. The indirect output effect includes purchases of other goods and services for the operation and in addition sales of various levels of suppliers to the industry must be figured. To this should be added the induced impacts of wages and salaries of mine workers and suppliers. The following figure illustrates an average production year:

Direct impact	$ 65.3 million
Indirect impact	35.4
Induced impact	118.9
Total impact	$219.6 million

Estimated employment associated with the proposed activity are projected in a similar manner using BOM multipliers for an average year of production:

Direct impact	324 employees
Indirect impact	235
Induced impact	1425
	1994 employees

The analytical process of developing input/output multipliers at the local level is questionable. For that reason much of the county impact assessment is oriented towards a direct measure of effect.

Mitigating Measures

No adverse economic impacts requiring mitigative measures have been identified. The economic impacts generated by the proposed project have a favorable effect upon the area.

5.3 LAND USE

The study area delineated in this survey element embraces the 7-county region as described in Sections 5.1 and 5.2.

Baseline

Current Regional Land Use - Land use activities in the 7-county 5500 square mile region are primarily agrarian in nature with urban development occurring along Gulf and Bay coast lines in Charlotte, Hillsborough, Manatee and Sarasota counties. The interior of the region houses smaller communities astride long established north-south railroad or highway routes. The lone exception being the city of Lakeland, an important commercial center located in Polk County.

Based on a recent USGS Land Use Survey only 9.3% of the 7-county area was measured as "Urban or built up" in 1975. This amounts to 520 square miles, housing an estimated population of 1.2 million.

Nearly 63% was listed as crops, pasture, groves, and rangeland while barren land including mining operations totaled only 6% of the study area. The remaining 22% was forest, wetland and water.

Manatee County - The county is presently dominated by open space land uses. Rangeland and agricultural uses made up approximately 75% of the county in 1975. More intense land uses described as urban build-up within the Areawide EIS, accounted for only 7.67% of the county in 1975 and were located predominately in the area immediately around the communities of Bradenton and Palmetto, and on Anna Maria Island and Longboat Key.

There are three predominant catalysts for land use change and development in Manatee County which can be expected to continue present trends. The most significant is the coastal geography of the county which is attractive to urban uses such as residential, commercial, and industrial development. The coastal area can be expected to remain the dominant locus for future growth. The second catalyst is existing and planned highways, which act as a spine for the growth areas of the county. And the third is the natural resources that exist in the form of phosphate deposits and will attract the mining industry.

Residential and other urban uses can be expected to increase proportionately to population growth. The county is projected to nearly double in population by the year 2000; going from 123,500 to 241,600 in twenty-five years.

Future Regional Land Use - Typically, agricultural land uses are reduced as urban encroachment occurs. Main losses of economic importance in the 7-county region are some 22,000 acres of orchards and groves, primarily in Hillsborough, Manatee and Polk counties. Considerable amounts of pasture and rangeland will also be removed from agricultural usage during the period 1975-2000 by mining operations. Much of this displacement will be temporary as reclamation of mined lands will return much of the former agricultural land to productive uses.

Urban development is projected to total approximately 500,000 acres by the year 2000. This is a 43% increase over 1975 but amounts to 13% of the total regional land area.

It is generally forecast by business and government planners that future urbanization of West Central Florida will expand around existing centers of population and transportation routes. This is true for the region as well as Manatee County.

Impact

The 10,394 acres that make up the Swift mining site represent 0.3% of the 7-county region. The majority of the site, approximately 78%, consists of unimproved agricultural land and rangeland with poor soil conditions.

The site is proposed for agricultural use in the Manatee County Comprehensive Plan, which is consistent with the planned mining operation because of the proposed land reclamation program.

The geographic location of the Duette Mine, in the northeast corner of Manatee County, gives it a central position within the region, and tends to lessen its impact upon urban Manatee County. In addition, the existing highways allow the mine to be served equally by the built-up areas of Polk County, to the north along SR 37, as well as Manatee County to the west along SR 62. SR 62 also puts the built-up areas of Hardee County within reach.

It is anticipated that many of the mine workers will have been employed at other mines within the region. Experience with other mine operations adjacent to the site indicates that the built-up areas of Bartow, Mulberry, Ruskin, Parrish, Myakka City, Palmetto and Bradenton are sufficiently close to serve the residential needs of mine employees. Because of this, no new built-up areas or significant expansion of existing built-up areas will be attributable to the mine.

The proposed action will not significantly affect the future growth patterns within the built-up coastal areas of Manatee County. The anticipated growth in residential land use will remain in and around existing built-up areas throughout the 20 year life of the mine operation. The commercial and institutional land uses generally associated with residential development will also develop where they are presently concentrated.

The mine site is principally made up of agriculture, forest, wetland, rangeland and barren land. The mine would largely displace unimproved rangeland, which made up 47.4% of the County in 1975.

Agricultural land would be significantly increased by the mining process. This is attributable to creation of improved pasture land once the disturbed land is reclaimed. Approximately 5516 acres of agricultural land would be gained by the region.

The end result of the Swift mining operation on the county would be a net improvement in agricultural land uses.

Mitigating Measures

All necessary mitigating measures for land use will be provided for through the reclamation process described in detail in the Reclamation Methodology Resource Document. No significant adverse impacts on land use requiring additional mitigating measures have been identified.

5.4 COMMUNITY SERVICES AND FACILITIES

Baseline

Regional Facilities - The 7-County Region contains a variety of community facilities: Water supply, solid waste removal, electricity supply, transportation systems, medical facilities, schools, parks, recreation facilities, police and fire protection. The majority of the built-up or urban area of the region is served by facilities operated on a local or county level. The regional scale facilities tend to serve more than one locality and cross county lines. Such facilities include the highway system, railroad lines, electricity supply and certain law enforcement and recreation facilities. Section 5.6 addresses the local and regional highway system and railroad lines.

Facilities Within Manatee County - Community facilities provided on a local and county level include governmental administration, law enforcement, fire protection, public water supply, waste disposal, health care, recreation and education.

Without the proposed action, the majority of the facilities cited would continue to serve the population within the built-up areas of the county.

Impact

Region - The Duette Mine operation is to replace production by a mine scheduled to be phased out of production. The impact on regional community facilities will be absorbed by the decreasing demands of the former mine.

Electricity is a major element of phosphate processing. The proposed mine would be served by the Parrish Plant of Florida Power & Light Company System, however, other companies serving the region could augment the Parrish Plant when necessary. Upon completion of mining operations in 20 years, generating capacity will be available to serve the projected population growth that will locate in the region.

The highways that serve the region will be sufficient to serve the trips generated by the Duette Mine personnel. Very little traffic other than personnel trips to and from work is anticipated. Ore material will be moved by railroad. Improvements and extensions to existing lines will be made to serve the requirement of the Duette mine and other mines in the region. Section 5.6 discusses transportation in more detail.

Other regional community facilities largely serve the residential population base and can be expected to be expanded upon through general population growth pressures. The 300 personnel employed by the mine will not affect the demand for services.

Manatee County - Manatee County and local jurisdictions provide community facilities which are not of a regional scale. Such facilities generally serve the built-up area of the County where the population can be expected to be concentrated within future years.

The Duette Mine is not expected to have a significant effect upon potable water supplies within the County. Fire protection and law enforcement facilities largely serve the built-up area and there is no reason to anticipate any increased service as a result of the proposed mine. Fire protection and emergency medical services will be provided on the mine site. Domestic waste generated by the mine will be treated on-site. Industrial wastes will be recycled during the mine reclamation process.

The health, education and recreation facilities within the County are not expected to receive a significant impact because they are directly related to the growth in population. Manatee County currently provides an acceptable level of public facilities and services by public and private support. Most services are based on population or market demand and increase annually with growth. The small population generated by the proposed mine will be dispersed over several residential areas, and only a portion will be in Manatee County. Therefore, minimal impact will be perceived in the county.

Mitigating Measures

No adverse impacts requiring mitigating measures have been identified

5.5 SENSITIVE MANMADE AREAS

Baseline

The intent of this element is to identify those manmade areas or features that are susceptible to being adversely impacted by the proposed activity.

Typically for a mining operation this might include: residential areas or even small cities or towns and other urban development; transportation systems, roads, airports, railroads, ports; and rural development of farms, nurseries, feedlots, ranches, and other intense agricultural uses.

The Duette Area - Section 5.3 Land Use addressed general characteristics of land development within the 7-county region and more specifically Manatee County where the proposed mining activity will occur.

Presently, only a few manmade features are to be observed within the rural Duette area. They include three state highways and the county road connecting SR 62 with SR 64 to the south.

Numerous private roads serve area individual homes and ranches.

Residential development includes some 30-40 dwellings within two miles distance of the proposed mining operation. Several are located in the old settlement of Keentown, an out-parcel in the center of the mine site. A few more are on SR 62 near the SR 37 intersection and the Duette School. Another scattered cluster of housing is west of the mine site near the Bunker Hill church.

Other urban features include the Duette elementary school, the county's only one-room school house, a small country church, two small cemeteries and a utility substation. Rural manmade features include: fencing, drainageways, farm buildings and structures, planted crops, groves and forests.

Section 5.7 will identify and discuss certain archaeological and historic sites located within the mine site area. There are no historic sites or structures of sufficient significance to meet the National Register of Historic Places criteria. A single prehistoric site does meet the significance criteria and is recommended for preservation or archaeological excavation.

Impact

The primary impact of a surface mining operation on any on-site manmade feature would be its total removal by site clearing.

Secondary impacts are those environmental conditions that might change because of mining and processing that would effect human habitation and public facilities. These might include: increased noise levels, air pollutants, or increased vehicle traffic on local roads.

Primary Impacts - No existing families will be displaced by mine operations. Several old homesites and prehistoric sites will be removed by mining operations. A prehistoric site which meets National Register criteria is recommended for protection.

Secondary Impacts - The local highway and road system will witness increasing vehical trips during mine operations. Section 5.6 addresses this issue and indicates that projected traffic is light and would not have a negative impact on road conditions.

Other secondary impacts on nearby residents, the school and church will be increased noise levels when mining operations are located close by. Wind blown soil may also be a nuisance to nearby residents, but should be controllable through proper clearing and revegetative techniques.

Another source of fugitive emissions will be the drying operation and railroad car loading. Abatement measures are required and the site is well inside the property and over a mile from any residence.

Existing agricultural activities adjacent to the proposed mining activity should not be impacted by Swift operations other than a potential for ground and surface water changes in volume or flow. This is addressed in the appropriate section of the EIS.

Agriculture land uses on-site undergo a significant positive economic change as rangeland is mined, reclaimed and then turned into improved pasture or seasonal crop lands.

Mitigating Measures

Adverse impacts and their associated mitigative measures for cultural resources, transportation, and air quality have been examined in their respective sections. No additional adverse impacts requiring mitigating measures have been identified.

5.6 TRANSPORTATION

Baseline

Roads - The road network in the primary impact area of the proposed Swift Duette Mine is shown on Figure 5.6-1.

All thoroughfares with the exception of Duette Road are state roads. All state roads are twenty-four foot wide, paved, undivided, rural sections.

The only planned improvements to the road network in the primary impact area is the extension of State Road 39 to the south, to connect to State Road 64.

Table 5.6-A gives the latest F.D.O.T. twenty-four hour average daily traffic counts for the road network adjacent to the proposed mine site.

Future traffic flows without the proposed mine are also shown in Table 5.6-A. The 1977 F.D.O.T. counts were used as a base, and traffic flows were projected to the year 2000. An 8% growth factor was assumed.

Table 5.6-A Project Highway Traffic Without Proposed Mine

Location	1977	1980	1990	2000
State Road 39	1119	1410	3044	6572
State Road 62 (west of SR 37)	1694	2071	4471	9653
State Road 62 (east of SR 37)	1372	1728	3731	8055
State Road 37	1129	1422	3070	6628

As per the "Highway Capacity Manual, 1965" published by the Transportation Research Board, Washington, D.C., service level "A" exists during the peak hour on all roadways within the

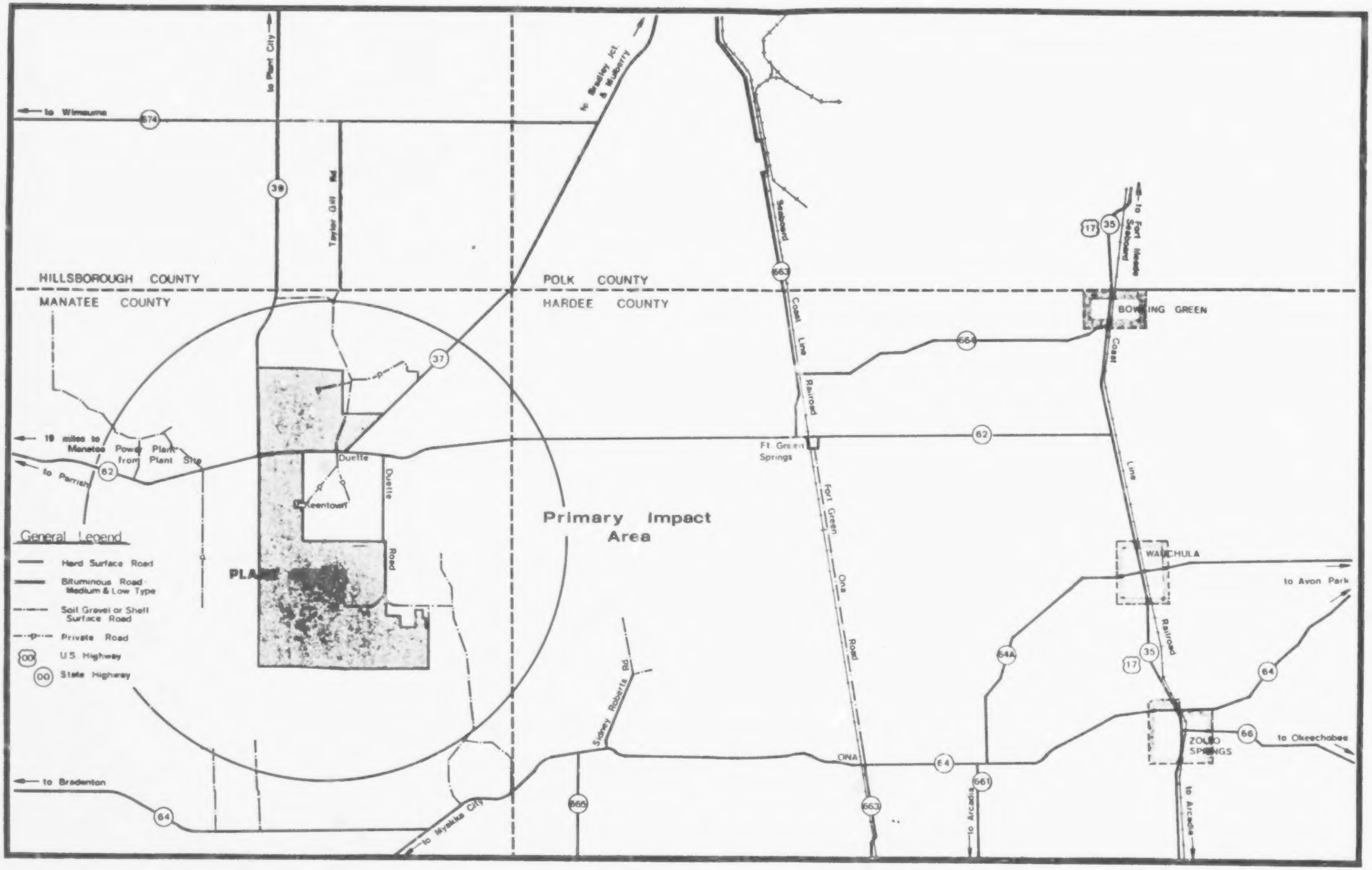

FIGURE : 5.6 - 1

EXISTING TRANSPORTATION NETWORK

SOURCE : CIVIL ENGINEERING CONSULTANTS, INC.

U.S. EPA - REGION IV
DRAFT ENVIRONMENTAL
IMPACT STATEMENT FOR
SWIFT AGRICULTURAL CHEMICALS
CORPORATION
PROPOSED DUETTE MINE
MANATEE COUNTY, FLORIDA

primary impact area.

Railroads - The existing railroad network, which will be affected by the proposed Swift Duette Mine, is shown on Figure 5.6-2. Seaboard Coast Line Railroad supplies the freight service in the study area and throughout most of the state.

The Polk and Hillsborough County phosphate district generates the majority of rail traffic to the Tampa and Lakeland terminals. Based upon actual tonnage of phosphate shipped through the Port of Tampa, approximately 800 of the 1600 cars per day handled by the main Tampa terminals carry phosphate ore and various by-products.

The Lakeland terminal is somewhat smaller and handles approximately 900 cars per day of general freight and some phosphate by-products according to the previously cited rail plan.

In the heart of the phosphate district, at Mulberry, is the main yard, which handles some 1400 cars per day.

Assuming that rail car traffic will increase with the increased mining of phosphate ore, there should be a 25% increase in the number of rail cars by 1990.

A Stanford Research Institute study predicts a 50% increase in tonnage between 1990 and 2000. Resultant total tonnages will create the demand for approximately 1500 cars on a daily basis, moving phosphate into Port Tampa, in the year 2000.

Ports - Port Tampa and Port Manatee by their geographical location will probably handle the majority of phosphate generated at the Swift Duette Mine. The latter port must develop a major bulk loading facility in order to serve the future phosphate mines proposed in Manatee County.

The Port of Tampa is the nation's 8th largest port facility. During 1977 over 46 million tons of cargo passed through this facility. Approximately 24 million tons of that total was attributed to the handling of bulk phosphate and phosphatic chemicals.

Port Manatee is located as shown on Figure 5.6-2. The facility began operations in 1970 and is capable of handling general cargo along with maintaining liquid and dry bulk handling facilities. Total tonnage handled in 1977 was 3.4 million tons.

Interstate 75 Construction - The construction of Interstate 75 between Tampa, Manatee, and Sarasota Counties will have a profound effect on all modes of transportation. Construction has begun in Sarasota and Manatee Counties and is scheduled for completion in the early 1980's. The section between northern Manatee and Tampa should be completed sometime thereafter in the mid 1980's.

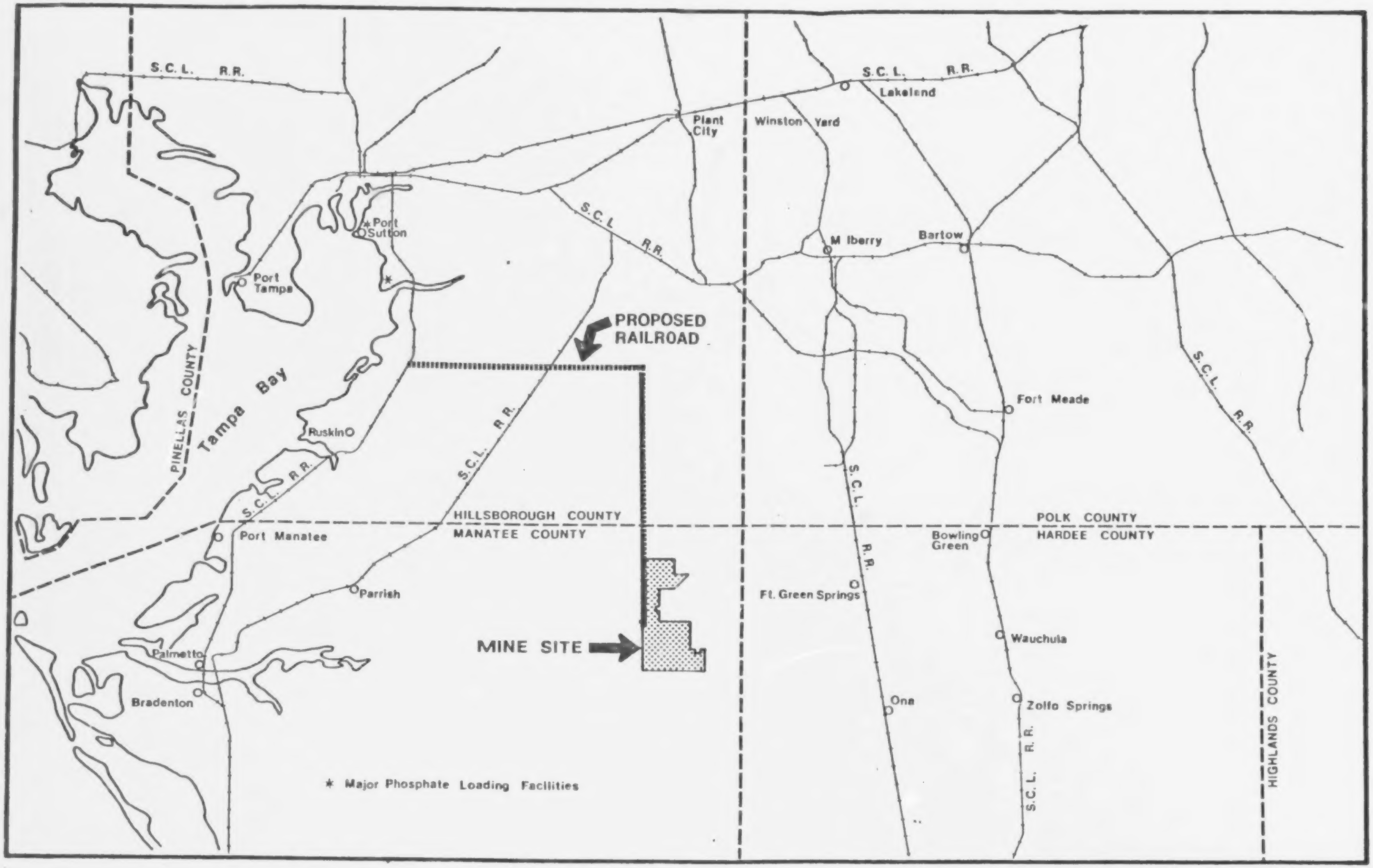

FIGURE : 5.6-2

EXISTING RAILROAD FACILITIES AND PORT LOCATIONS

SOURCE : CIVIL ENGINEERING CONSULTANTS, INC.

U.S. EPA – REGION IV
DRAFT ENVIRONMENTAL IMPACT STATEMENT FOR SWIFT AGRICULTURAL CHEMICALS CORPORATION
PROPOSED DUETTE MINE
MANATEE COUNTY, FLORIDA

Impact

Roads - The road network shown in Figure 5.6-1 is the primary impact area and this area will undergo an increase in vehicular traffic due to the proposed mining operation. The initial increase will be due to the construction of the plant site, whereas later increases in traffic will be due to the daily operation of the mine itself. Traffic generation from the Beker and Grace proposed mines has been considered in this analysis.

Based upon an average employment of approximately 450 construction workers during the two-year construction phase, 1170 trips per day will be generated. Eighteen to twenty percent of those trips will be truck traffic. The a.m. arrival and p.m. departure of the workers will create the peak hour periods of vehicular activity. The peak hour volume will be approximately 500 trips per hour.

The effect of the construction phase traffic will not cause a significant impact upon the road network shown in Figure 5.6-1.

The mining operation will generate approximately 1630 trips per twenty-four hour period.

The major peak hour will occur when maintenance and dragline crews change shifts between 6:30 and 7:30 a.m. It is anticipated that 190 trips will be generated during that hour.

Traffic generated by the Swift Duette Mine will not have a significant impact on the thoroughfares within the primary impact area. Service Level "A" (Free Flow) will be maintained through 1985. However, the normal traffic growth expected after that period will cause a decrease in service levels by 1990 (Table 5.6-A). Service Level "B" is expected on all extended sections of state roads by 1990, and Level "C" will be developed by 2000. These levels will occur during the peak hour of mine operation.

The state road intersections (i.e., S.R. 62 at S.R. 39, S.R. 62 at S.R. 37) will operate at lower levels of service than the extended road sections. Should these intersections remain geometrically unchanged, Service Level "C" will occur by 1980 during the major peak hour. By 1990, service levels will decline to "D", and by 2000 these intersections will be at capacity. After peak periods, these intersections will operate at Service Level "C" or better through 2000. The lowering of service levels is a significant negative impact.

Duette Road will be the only entrance to the plant site. Consequently, it will undergo the most severe effect. However, the road will still operate at Service Level "B" or higher through 2000.

There is no existing railroad spur that could serve the proposed site. The possibility that no railroad will be built is very remote, especially when there are two mines already approved by Manatee County in the immediate area (i.e., Beker Phosphate and W. R. Grace and Company). Should the estimated three million tons per year of phosphate ore be transported by truck, it would create a significant negative impact on the road network in the primary impact area, and on the road network adjacent to the nearby seaports.

Railroads - The proposed mining operation will generate one hundred, 80-ton rail cars per day. Approximately 80% of that traffic will go to a seaport. Should a rail system be constructed to the Swift Mine, it will be able to transport the ore using the "Unit Train Method" now being used by mining operations in Polk and Hillsborough Counties. This method theoretically gives a railway system an infinite capacity.

The constraints on such a system are not the capacity of the rail line, but the capacity of the loading and unloading facilities, and the storage capacity at the Port destination. The availability of cars and locomotives is also a limiting factor. The addition of 100 rail cars on this system will create a negative impact on the rail system.

The rail system serving Port Manatee is in its early stages and basically has no capacity problems. The increased traffic from the proposed mine would not have a significant impact, assuming a suitable bulk loading facility was constructed at the Port, with adequate storage capability.

Ports - Three million tons of phosphate ore will be produced per year by the proposed Swift Duette Mine.

Presently, the Port of Tampa has the only major bulk loading facilities capable of handling the anticipated production from the proposed mine. The existing loading facilities will have the ability to handle the mine output without any significant adverse impacts. However, due to the lack of storage facilities, rail cars, and traffic congestion on U.S. 41 caused by the shipment of phosphate ore, it is apparent that there will be a significant negative impact on the Port of Tampa area as a whole from the movement of the projected three million tons per year.

Should Port Manatee construct a major bulk loading facility, the Swift Duette Mine project would create a very significant beneficial impact on those facilities and the Port area in general.

Mitigating Measures

Roads - The recommended modifications at intersection of S.R. 62 and Duette Road would include widening to incorporate turning lanes and possibly signalization.

Railroads and Ports - As a general overview, the construction of a railroad line directly to Port Manatee, should the Port develop a major loading facility, would be the most profound mitigative measure. Increased rail traffic would not impact the congested Port of Tampa railway network and would prevent further burdening of the Port of Tampa storage facilities and Port traffic circulation.

5.7 ARCHAEOLOGICAL AND HISTORICAL PROPERTIES

Baseline

Two field surveys of the Duette Mine tract were undertaken to locate historic and prehistoric cultural resources on the property, to evaluate the significance of the resources, to determine impact on the resources and to recommend mitigative measures. The first survey was carried out in December 1974 (EcoImpact, 1974) as part of a Development of Regional Impact report. The second survey was designed as a test of the prior work and was conducted as part of the investigation in preparation for the present Environmental Impact Statement (Grange and Williams, 1978). Details and documentation of these surveys may be found in their respective resource documents.

Although there are many ecological zones within the region, many formulations view the area as having two major zones--a coastal strip and an interior hinterland. These two major zones are connected by streams and rivers flowing from headwaters in the interior toward the coast. The interior or "hinterland" region contrasts with the coastal zone in resources. It lacks the abundant shellfish which support more dense prehistoric populations on the coast. The poorly drained pine, flatwood and swampy interior has often been interpreted as a hunting area. Although hinterland utilization models developed by earlier archaeological work are not fully supported by present data, prehistoric population density was much heavier in the coastal area than in the hinterland.

The Duette Mine is within the Manatee Archaeological Region, but is close to the boundary of the Central Gulf Coast Region and Glades Region and cultural influences from both of these spatial units affect the area. Paleo Indian sites (circa 12,000-8000 B.C.) are primarily found along the coast and in locations drowned by rising sea levels. Early Archaic Period sites may also be inundated. Late Archaic sites, dating after 5000 B.C. have been found throughout the region around the Duette Mine. Many sites attributed to this period are lithic scatters lacking the diagnostic projectile points. By the close of the Archaic Period, about 2000 B.C., sea level had approximated its modern level and associated landform, flora, and fauna of today were similar to those utilized in the past.

The Orange Period is defined by the introduction of ceramics and about 1000 B.C. Deptford pottery appears in the Central Gulf Coast Region. Sand tempered ceramics from the Glades area to the south are also present in the sites in the Manatee Region. Burial mounds appear in this period. A few mounds are found in the interior hinterlands and such features may represent significant cultural resources. Later sedentary peoples in the area are represented by the Perico Island and Weeden Island/Santa Rosa-Swift Creek Periods between 500 B.C. and A.D. 1300. These periods may also be represented in the Duette Mine tract, since Weeden Island mounds have been found on adjacent property. The focus of settlement remains on the coast during these periods and in the succeeding Safety Harbor Period of A.D. 1300 to 1700. Safety Harbor sites are also present in the interior areas and form the basis for the now modified hinterland hypothesis.

Spanish exploration of the sixteenth century, as well as later Euro-American activities, were largely focused on the coastal area and the lower reaches of the Manatee River which has its headwaters in the Duette Mine tract.

American settlement of the area came after initial land surveys in 1843. The Duette Mine area was mostly patented to the State of Florida in 1856 or later. Homesteading of sites adjacent to, but not on, the mine tract occurred in 1878 although cattle may have been run in this area during the Civil War Period. Most of the Duette Mine tract was deeded to the Florida Southern Railroad Company in 1883, although a small area was included in the Disston Purchase in 1883. There were only limited individual land holdings in the mine tract in the 1880's.

Most of the property was utilized for ranching purposes, with associated pasture improvement operations. Field survey of homestead locations on the property revealed no standing structures and the remains of collapsed buildings were all wire-nail constructed and thus probably post-date 1891.

Impact

Historic Period Sites - The criteria for determining significance of historic sites is stated in 36 CFR 800.10 "Procedures for the Protection of Historic and Cultural Properties".

The Duette Mine tract area played a part in the agricultural development of Manatee County. However, the historical review of the general events and specific individuals and companies involved in the settlement process revealed no historical reference to individuals, events, sites, or structures of sufficient significance to qualify an associated site for National Register status. There are, then, no historic period sites which meet National Register criteria on the property. Thus, although some historical period homestead loci will be destroyed by mining operations, these impacts will not adversely affect regional historical resources.

A total of five prehistoric sites were located on the property during the course of the two field surveys. The work in preparation for the EIS drew upon settlement pattern and its relationship to ecological data gathered in earlier surveys of similar mining tracts around the Duette site. A predictive model was developed which allowed the identification of areas where there was a higher probability of the presence of archaeological sites. These areas are within 2000 feet of permanent water (e.g., the streams on the property), within 4000 feet of a hardwood hammock and on the better drained soils within these parameters. All three sites on the Duette Mine tract located in the EcoImpact survey were within the expected locations. The EcoImpact survey investigated the entire mine tract. As a further test, a sample of 30% of the high probability area was resurveyed by the EIS team and two additional prehistoric sites were located, both within the expected zone (Figure 5.7-1). Both sites were lithic scatters marked by two chert flakes at each site.

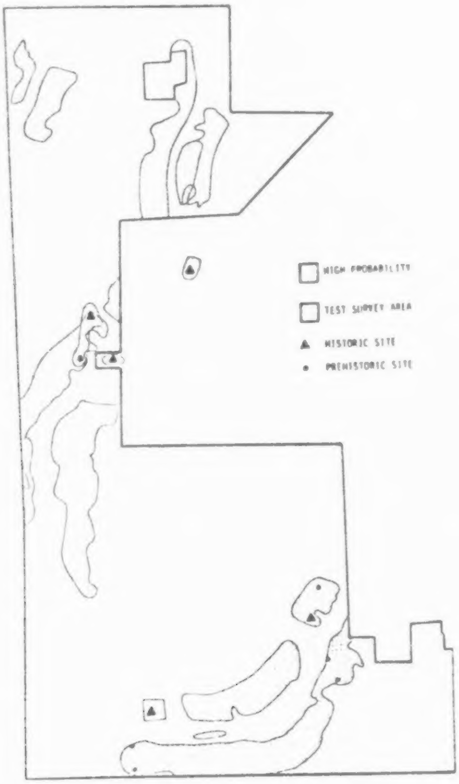

Figure 5.7-1 Archaeological and Historical Sites Probability and Location Map

Thus, two surveys resulted in locating five prehistoric sites. Four were lithic scatters and one was a small sand mound. An additional mound, formerly on the property, was destroyed years ago during the development of an orange grove.

The lithic scatter sites were all very low density locations producing only debitage from chert preparation and no diagnostic artifacts for cultural classification. All were in disturbed locations where orange grove cultivation or farm roads resulted in destruction or disturbances. Tests revealed no preserved cultural stratigraphy or site integrity. None of these sites meet the significance criteria of 36 CFR 800 and, although they may be destroyed in mining operations, the impact will not result in loss of significant archaeological data. The recorded site location information contributes to the growing body of information about the settlement pattern and ecological relationships of sites in the riverine headwaters, however.

The Carruthers Mound is deemed to meet the significance criteria on the ground that it may contain data of regional archaeological importance. A test by EcoImpact did not produce diagnostic artifacts and the site remains of unknown cultural classification. However, mounds represent a more settled way of life in an area which has been characterized as a "hinterland" hunting zone and none of these mounds has been excavated by archaeologists using modern techniques. Such sites, few in number, are important cultural resources. The Carruthers Mound is in an area which is not scheduled for mining and hence will not be destroyed in that operation. It would, however, be isolated from its former environment, which is identified as an adverse impact since associated archaeological data may be present in the surrounding area.

Mitigating Measures

Two mitigative alternatives exist for the Carruthers Mound. One is to preserve the site and protect it from destruction or damage. The DRI report for the Duette Mine proposed to accomplish this goal by fencing the mound. It was the opinion of Grange and Williams (1978), however, that fencing the mound alone will not adequately protect it and its immediate environment. The area surrounding the mound is considered crucial to site interpretation. In fact, any full-scale excavation of the mound would also require testing at least 100 meters around the mound to be considered adequate. Cultural and natural data directly related to mound construction should be within that distance although this is only an estimate due to lack of data from excavated sites of this type in this area.

The second alternative, if preservation is impossible, is to excavate the site. In this case, this should be understood to include investigation of an area around the mound as well as the mound itself.

5.8 RESOURCE USE

Energy - Electricity, gasoline and diesel fuel will be the energy sources used during the construction phase of the project. Once in operation, the mine and plant will operate on electric power supplied by Florida Power & Light Company.

Fuel oil will be used to provide thermal energy for the product dryers, and gasoline and diesel fuel will be used for motor vehicles.

Average operational demand power will represent 4.4% of the transmission line capacity, and 2.9% of the Parrish power plant capacity.

Tables 5.8-A and 5.8-B show energy consumption by phase of operation and by area during normal operations, based on preliminary engineering estimates (Swift DRI, 1978).

Energy consumption will account for at least 20% of the total operating costs, with increases probable in the near future due to the ever increasing costs, utility companies must pay for fossil or nuclear fuels. Therefore, considerable economic incentive is given the company to provide for maximum efficiency and conservation of energy. The design has been reviewed for possible mitigative efforts to reduce requirements for electric power and fuels to minimum levels.

Table 5.8-A Energy Consumption by Phase

Phase	Avg. KVA	Dryer Fuel Oil Gal/Day	Gasoline Gal/Day	Diesal Fuel Gal/Day
Construction	3,000	0	500	500
Start-up	51,800	12,125	350	350
Operation	51,800	28,250	350	350

Table 5.8-B Energy Consumption by Area

Area	Horsepower (Connected)	Average Load KVA
Mine	26,501	17,859
Washer	4,378	3,086
Feed Preparation	6,525	4,951
Flotation	5,892	4,534
Waste Distribution - Waste Disposal	26,352	18,458
Reagent Storage - Offsites	648	562
Wet Rock Storage	854	615
Dryer, Load Out	2,239	1,613
TOTAL	73,389	51,768

Water - The existing ground and surface water systems, their resource availability, effect of use, and conservation are discussed in detail in separate sections of this report.
Mineral Resources - The prospecting base of 245 holes used for reserve identification by Swift is statistically adequate to define the property's reserve potential for planning purposes. The stated reserves for 60 million short tons of product as estimated by Swift are recoverable at best management practices, considering both mine and process recovery. There is a possibility of an expansion of the reserve by improved technology and/or economics. The mine life could be extended by perhaps 10-25% by improvements in either of those areas. However, assuming that this additional ore would be less concentrated, the overall production rate, with no expansion of the processing facilities, might decrease.

There is sufficient incentive due to reserve and development investment for Swift to provide the practices necessary to insure maximum recovery.

Certain portions of the property, as indicated in other sections of this report, have been withheld from mining including portions of the major stream courses on site and a wetlands area. Ore underlying these areas, which may amount to several million tons of product, is not planned to be recovered due to regulatory constraints governing mining in wetland areas.

The uranium content of the recovered product is estimated to range from 50-100 ppm. This is not as high as in some Polk County deposits presently being exploited for both phosphate and bi-product uranium. No current plans for downstream extraction of the uranium from the phosphoric acid have been identified because extraction would be performed by the consumer of the rock production rather than Swift.

At the planned 3.0 million short tons of product per year rate, Swift will deplete the deposit's presently identified recoverable reserves in the projected 21 year mine life. The 60.0 million short tons of the economic reserves represent 4.3% of the identified Florida resources having a cost of less than $20 per short ton of recoverable product (Zellars-Williams, 1978), and 1.5% of the total identified resource.

Neither the Department of Energy at state or federal levels nor any other agency hold regulatory authority over the use of energy at this time.

The agency charged with authorizing diversions from either ground or surface water is the Southwest Florida Water Management District which is a state regional agency charged with water conservation.

This agency issues a permit for an allowance of a specific amount of water to be withdrawn from either ground or surface water resources and implements requirements for mitigative measures to offset such diversions.

There is no direct regulatory authority over depletion of mineral reserves. The Manatee County Ordinance indirectly has jurisdiction with regard to Master Plan preparation and annual mine permit review. These plans locate, quantify, and define the production rate. The Development of Regional Impact process approval requires a general explanation of the methods by which recovery of mineral reserves will be optimized.

6.0 COMPARISON OF PROPOSED ACTIVITY WITH AREAWIDE EIS RECOMMENDATIONS

The Final Areawide Environmental Impact Statement for the Central Florida Phosphate Industry published by the Environmental Protection Agency in November 1978 evaluated the impact of various alternative scenarios of phosphate mining in central Florida. The EPA recommendations represent a scenario of phosphate development which was determined to be as compatible as practicable with other desired and intended land uses. This scenario provides a decision making tool for all new source phosphate mines in central Florida.

The following discussion compares the proposed activity to the EPA recommendations for mining and beneficiation. The recommendations and clarifying statements are underlined followed by a description of the proposed activity.

- Eliminate the rock-drying processing at beneficiation plants and transport wet (6-20% moisture) rock to chemical plants.

  Only rock to be utilized in triple superphosphate, elemental phosphorus, defluorinated rock feed, or other fertilizer processes requiring dry rock would be dried - and this would be at the chemical processing complex or at dryers permitted by DER prior to publication of the DEIS. A possible exception on a case-by-case basis could be made for rock to be shipped outside of Florida for chemical processing; if the energy for transporting the moisture were greater than the energy saved by eliminating drying, drying at the beneficiation plant would be considered if air quality (including radiation could be adequately protected.

Since the Areawide EIS study was undertaken, important study assumptions relative to air quality were mitigated by a significant action of the U. S. Congress. The Clean Air Act Amendments of 1977, required the application of Best Available Control Technology (BACT) to all significant sources and source modifications which had potential to deteriorate air quality. The recommendation to eliminate rock drying in the Areawide EIS was based upon greater allowable source emission rates than are now permitted by U. S. EPA Prevention of Significant Deterioration (PSD) Regulations promulgated under the 1977 Amendments. For example, study assumptions for particulate matter were limited by allowable emission rates as provided for in the Florida Administrative Code (F.A.C. 17-2.05,2, Process Weight Table). This rule permitted particulate emissions at least twice as great as allowed under the PSD Regulations. A conclusion of the Areawide EIS proposed action was that the phosphate industry pollutant contribution would remain relatively constant after 1977. However, the PSD Regulations suggest that the contribution should decrease as new processing facilities are constructed and older less efficient control systems are replaced with new technology.

By establishing maximum increments of allowable deterioration, the PSD Regulations effectively restrict availability of the air resource. Once the available resource is consumed by competing interests, no significant additional source effect can be permitted without a corresponding reduction in effect from another source.

Thus, the objective of the Areawide EIS to protect air quality will be attained by an enforceable and pervasive system of air quality controls that exert influence over all major industrial source contributions.

Swift proposes to contruct a rock drying facility at the Duette Mine site. Two fluidized bed dryers are planned for drying 262 tons per hour each (dry basis) of phosphate rock from 13 to 2% moisture.

The proposed drying facility is dictated by market conditions. Total acceptance of wet rock, as the basic form of the phosphate rock commodity on the world market, is not expected for some time. Many users have small phosphoric acid plants and the designs vary widely making conversion to wet rock not only expensive, but technically difficult. Conversion to wet rock also requires installation of wet rock grinding in addition to major wet phosphoric acid process design changes. Significantly, capital for the modifications is not readily available in many developing countries.

Some dry rock is used to produce triple superphosphate for which no wet rock process exists. If drying at the acid plant is desired, small dryers located at small plants are inefficient and very expensive compared to the large units employed by rock producers.

In terms of operating costs at the mine plant site, shipping wet rock is less expensive than drying the rock. These costs, however, are only transferred and increased if the customer is not capable of processing the wet rock since water must be shipped and then removed by drying. Heavier wet rock results in higher delivered costs at all points of delivery except the lower Mississippi. Beyond the 1,000 mile radius, shipping costs exceed drying costs; therefore, the competitive marketing cost becomes a major factor. Product grade, quality, and condition become more important in the world market and customer specifications are an important consideration.

More energy in the form of fuel oil is consumed to dry the rock than is consumed to ship the additional water in the wet rock, assuming that the rock will not be dried at the final destination. Analyses were performed to examine how energy consumption to ship moisture in rock increases with shipping distance and how it compares with the energy consumption to dry the rock. In the case of rock dried at the final destination, energy consumption would be the greatest since the energy consumed in shipping the water would be added to the energy consumed in drying the rock.

As stated above, the proposed Swift drying facility is subject to PSD Regulations. These regulations require preconstruction monitoring of pollutant levels, application of Best Available Control Technology (BACT), and control of emissions to insure that PSD concentration increments are not exceeded. The rock dryers proposed for the Swift facility will utilize venturi-absorbers and wet centripetal vortex contact scrubbers. The application of this technology will reduce emissions of particulate matter and sulfur dioxide to levels well below state and federal standards. The application of BACT will also minimize the pollutant concentration levels of airborn radiation.

- Meet state of Florida and local effluent limitations for any discharges.

Pursuant to Section 401 of the Federal Water Pollution Control Act as amended (33 USC 1251, 1341), the State of Florida issues certification to each applicant for a National Pollutant Discharge Elimination System permit.

All recent NPDES permits issued by the State for phosphate mining facilities have been certified subject to the following conditions:

1. The applicant must comply with all applicable requirements of Chapter 403, Florida Statutes, and Chapter 17 series, Florida Administrative Code.
2. Issuance of certification does not constitute State certification of any future land alteration activities which require other Federal permits pursuant to Section 404 of P. L. 92-500, as amended, nor does it constitute approval or disapproval of any future land alteration activities conducted in waters of the State which require separate Department permit(s) pursuant to Section 17-4.28, FAC.
3. In accordance with Section 17-6.01(2)(a)2a.D., FAC, the following effluent limitations apply to all discharges designated as possibly containing contaminated runoff, process generated wastewater, or mine dewatering discharges from the mining and beneficiation of phosphate rock:

Characteristic		Discharge Limitations		Monitoring Requirements
		1-Day Max.	30-Day Avg.	
TSS	mg/l	25	12	1/week/24-hr. composite
Total P	mg/l	5	3	1/week/24-hr. composite
pH		6.0-9.0	6.0-9.0	1/week grab

If the above requirements are met, the discharge from this facility will comply with Sections 301, 302, and 303 of the Federal Water Pollution Control Act, as amended.

The Florida Department of Environmental Regulation reserves the right to modify the effluent limitations placed on each facility pursuant to Federal and State law. Modifications may occur should further water quality analysis of the proposed discharge, its volume and character, together with the flow and characteristics of the receiving body of water, indicate that the discharge will not meet and comply with applicable water quality standards contained in Chapter 17-3, Florida Administrative Code.

Effluent limits, and any additional requirements specified in the state certification, supersede any less stringent effluent limits in the NPDES permit. During any time period in which more stringent state certification effluent limits are stayed or inoperable, the effluent limits listed in the NPDES permit shall be in effect and fully enforceable.

o Eliminate conventional aboveground slime-disposal areas.

  The mining and reclamation plan for new-source mines should establish a method whereby the slimes (or slimes/tailings mixture) would be used for reclamation or some other purpose. The need for an initial aboveground storage area is recognized - as is the need for small retaining dikes around certain areas reclaimed with a slimes/tailings mixture. If the percentage of waste clay at a mine exceeds the proportionate amount that can be utilized, the incremental amounts beyond that which can be handled by new slime-dewatering methods may be placed in a holding pond for reclamation after adequate settling.

Swift has committed in their mine plan to use a sand-clay mix in land reclamation and thereby reduce the need for traditional, separate disposal areas.

A initial 480-acre conventional aboveground clay settling area is, however, planned for the mining operation. This area will receive all clay wastes generated before the sand-clay mix procedure becomes operational. The settling area will remain active throughout the mine life to receive clay wastes in excess of the sand-clay mix requirements and to serve as a secondary water clarification and storage area.

Based on current experimentation, sand and clay will be mixed in the approximate ratio of 2.5 to 1 (by weight). The mixture will be enclosed by levees averaging 14 feet in height. The enclosed areas will be filled to 9 feet above natural grade leaving a freeboard of 5 feet. Filling above ground is necessary to allow for subsidence of the material as it dewaters and consolidates, and to facilitate gravity flow within the water return system. Approximately 5,426 acres are planned for use as sand-clay-type disposal.

Upon completion of mining, drainage and drying will be induced to provide for subsidence and crust development of the clay settling area. Once the clay has subsided to the desired level, the exterior retaining dike will be pushed towards and away from the settling area to establish a lower grade slope and provide some coarser textured material for the interior soils.

- Meet Southwest Florida Water Management District consumptive-use permit requirements.

Withdrawals of ground water from the Floridan Aquifer will be limited to those rates and locations included in the Consumptive Use Permit (No. 27703739) granted by the Southwest Florida Water Management District (SWFWMD) in September, 1978.

The permit includes details of well location and pumping rates in the deep ground-water system and places restrictions upon effects in both the shallow and deep ground-water systems. The permit also requires the construction of a recharge-well system for the purpose of recharging 3.024 million gallons per day (average annual) from the unconfined surficial aquifer and/or secondary artesian aquifer to the Floridan Aquifer.

Swift is obligated to the terms and conditions of the Consumptive Use Permit. Should Swift fail to comply with all of the conditions, set forth in the permit, then the permit shall automatically become null and void.

- Provide storage that allows recirculation of water recovered from slimes.

  Storage capacity is to be determined during the pending DRI and/or the site-specific EIS based on local hydrologic characteristics. The designed storage capacity should allow for capture of 100 percent of water recovered from slimes for reuse.

The water recirculation system of the proposed mining and beneficiation facility provides 156.03 MGD to the clay settling area. Of this 156.03 MGD, 3.73 MGD are lost to evaporation, 11.487 MGD by clay absorption, 2.28 MGD are lost to seepage within the recycle system, and 142.27 MGD are returned to the process system. Ninety-nine percent of the water recoverage from slimes by the recycle system is either returned to the plant process or lost to non-discharge phenomena. The remaining 1%, or 1.43 mgd, is discharged.

- Use connector wells.

  Such wells offer an economical means of dewatering the shallow ground water from the water-table aquifer before mining, while replenishing a portion of the water pumped from the Floridan Aquifer for the purposes of transportation and beneficiation. Mining plans for new-source mines can continue to utilize this method of-dewatering - but only with the following precautionary measures: maximum utilization of water obtained from dewatering; monitoring by both industry and regulatory agencies to assure that the drained water meets recommended drinking water criteria chemically, bacteriologically, and radiologically at all times; and assurance that wells will be adequately cemented and grouted before being abandoned.

As a condition of the SWFWMD Consumptive Use Permit, Swift has agreed to the installation and operation of connector wells to recharge the Floridan Aquifer with an estimated availability of 3 MGD. Monitoring of the quality of the water being discharged from the shallow aquifer is required by the SWFWMD permit for various parameters and at a specified schedule. The water quality analysis will include the following constituents:

a) Total coliform count
b) Fecal coliform count
c) Gross alpha radiation (if greater than 15 pCi/l analyze for radium-226, total radium)
d) Iron
e) Fluoride
f) Phosphorous
g) Sulfate
h) Pesticides
i) Organic Carbon
j) Specific conductance
k) Nitrate
l) Phosphate (ortho, total)
m) Total dissolved solids
n) Total suspended solids
o) Turbidity

The permit further provides for the cessation of the introduction of the water from the upper system for cause.

- Address proposed regulations regarding radiation levels to be published by EPA and projected by mining and reclamation plans for new-source mines based on test borings of material to be encountered. The DRI and/or site-specific EIS should also develop a reclamation plan that considers radiation of spoil material and reduces as much as possible amount of radionuclide-bearing material left within 3-4 feet of the surface.

The projected indoor radon progeny levels by land type for the Duette site after reclamation are as follows: overburden reclaimed -0.008 WL (working level), sand/clay reclaimed - 0.009 WL, tailings reclaimed - 0.006 WL, clay sediments - 0.015 WL and the weighted average for the site - 0.009 WL.

All post reclamation criteria for the radiological environment were estimated without returned topsoil. The mining plan, however, suggests that approximately 2 feet of topsoil may be returned to some of the reclaimed area. This procedure is recommended, since expected guidance for construction of residential homes may require near background levels. The final clay settling area when returned to any land use will be most beneficially affected by returned topsoil. The 3-4 feet of returned topsoil recommended in the Areawide EIS, however, may have a high cost-benefit ratio in this region of lower matrix radioactivity.

If the final guidance (EPA, 1979) for reclaimed lands suggests an upper limit of predicted radon progeny in slab-on-grade homes of 0.009 WL (normal background of 0.004 WL plus the uncertainty of 0.005 WL), then the Duette site may have to consider the return of topsoil to any residential development site.

- Meet county and state reclamation requirements and include in the DRI and/or site-specific EIS an inventory of types of wildlife habitat in the area to be mined and the area immediately surrounding it.

and

- The mining and reclamation plan will take into account the protection and restoration of habitat so selected important species of wildlife will be adequately protected during mining and reclamation.

Wildlife habitats with their associated fauna and flora are described in detail in the Biology and Ecology section of this EIS and the attendant Resource Document. Restoration or preservation of some wildlife habitats have been incorporated in the mining and reclamation plan. Not all areas of the property will be mined or irrevocably disturbed. Of the unique communities on site, fifty acres of sand pine scrub and the 18-acre cypress dome will be preserved. Approximately 829 acres of cut-over flatwoods excluded from mining will be restocked with pine to enhance wildlife value.

Following the EPA recommendation stated below to preserve the section of the East Fork Manatee River scheduled for mining, all floodplain swamps of streams having greater than 5 CFS mean annual flow will be spared from mining and will be preserved without modification. The major stream corridors were found to be the most valuable wildlife habitat on-site.

- Protect or restore wetlands under the jurisdiction of the Corps of Engineers, Section 404, Federal Water Pollution Control Act, pursuant to 404 (b) Guidelines (40 CFR 230).

No specific boundaries of wetland areas have been officially identified by the Corps of Engineers. Three categories of wetlands were, however, established in the Central Florida Phosphate EIS:

Category 1 - Wetlands to be protected (not mined)
Category 2 - Wetlands which may be mined but must be restored as wetlands capable of performing useful wetland functions
Category 3 - Wetlands which can be mined without restoration as wetlands

Following are definitions for the categories established in the Areawide EIS. The definitions are presented as a suggested methodology for determining the limits of each category. These categories should be viewed as general guidelines to rank natural wetlands on Florida phosphate mining sites in terms of their value to regional hydrology, water quality, and fish and wildlife production. This categorization is intended to aide in the EPA review process of proposed Mining/Reclamation Plans for New Source Mines. The three categories are defined in further detail herein for application to the review process of Swift's Duette property.

CATEGORY 1 - Protected

Category 1 wetlands are strategically located in the regional drainage system and are associated with or contiguous to the primary rivers and streams (first order) and their branches (second order) within the major drainage basins of the mining region (e.g., Alafia, Peace, Little Manatee, Manatee, Myakka River, Horse Creek, etc.). These streams and associated wetlands provide an essential synergistic support to the regional ecosystem and environment that would have an unacceptable adverse impact if they were significantly altered, modified or destroyed. Category 1 wetlands may include wetlands associated with stream mainstems, headwaters and tributaries. Criteria for determination of Category 1 wetlands include but are not limited to:

(a) Mainstem Stream Wetlands : These are wetlands of first and second order rivers and streams upstream to the point where mean annual flow is 5 CFS. Protection shall extend to the lateral wetland boundary which shall be the 25 year flood elevation unless such calculated floodplain is less than one-half (1/2) the total floodplain as determined by dominant vegetation. In cases where the 25 year floodplain is less than 1/2 the total vegetated floodplain, a minimum of one-half (1/2) of the vegetated floodplain shall be protected from mining and significant disturbance by mining operations.

(b) Headwater Wetlands : These are wetlands as defined by dominant vegetation that are found as the continuum of first and second order rivers and streams upstream of the point where mean annual flow is 5 CFS. A minimum of twenty-five percent (25%) by area of headwater wetlands shall be protected from mining and significant disturbance by mining. It is the intent to maintain stream wetland continuity by protection of headwater areas.

(c) Tributary Wetlands : Tributaries are the lateral streams, creeks and other contiguous water conveyances (whether permanent, intermittant, or seasonal) that contribute flow to first and second order rivers and streams. As the importance of tributary wetlands to regional hydrology, water quality, and fish and wildlife habitat may vary considerably due to contiguity, vegetative structural diversity and hydroperiod, exact determination as Category 1 Tributary Wetlands will be made on a site by site basis. In all cases, however, a minimum of twenty-five percent (25%) by area of tributary wetlands shall be protected from mining and significant disturbance by mining.

Although not identified above, certain wetlands not part of stream floodplains may deserve special consideration for inclusion in Category 1. These include unique or unusual wetland vegetation communities that would be difficult if not impossible to re-create, wetland communities rare to the site or area, wetlands supporting populations of endangered or rare animals or plants, wetlands of sufficient size to be significant wildlife habitat (e.g., 50+ acres with considerable edge), or serve other essential environmental functions including water quality.

CATEGORY 2 - Mine and Restore

Category 2 wetlands can be generally characterized as larger, isolated swamps and marshes and those wetlands contiguous to but not protected under Category 1. This Category also includes wetlands that would otherwise be considered Category 1 but have been previously altered to an extent that significantly impairs natural wetland function. Category 2 wetlands may be mined if an adequate restoration program is proposed by an applicant. A restoration program must minimally include a reasonable assemblage of indigenous wetland plant species and be physically designed to positively contribute to regional water quality, hydrological function and fish and wildlife production. Criteria for determination of Category 2 wetlands include but are not limited to:

(a) Mainstem Stream Wetlands : These are all non-protected wetlands contiguous with the first and second order rivers and streams upstream to the point of 5 CFS mean annual flow. This category reaches to the upland edge of the floodplain boundary as determined by dominant vegetation from the designated limit of Category 1 wetlands.

(b) Headwater Wetlands : These are all non-protected wetlands that are found as the continuum of first and second order rivers and streams upstream of the point of 5 CFS mean annual flow. This category reaches to the upland edge of headwater wetlands as determined by dominant vegetation from the designated limits of Category 1 headwater wetlands.

(c) Tributary Wetlands : These are all non-protected wetlands is excess of 10 acres in size as determined by dominant vegetation that are contiguous with the lateral streams, creeks and other natural water conveyances (whether permanent, intermittant, or seasonal) that directly contribute flow to the first and second order rivers and streams of the region.

(d) Isolated Wetlands : These are all non-protected wetlands in excess of 5 acres in size that are not contiguous to mainstem streams, headwaters or tributaries but do have important functions in water quantity and quality control and fish and wildlife production. Isolated wetlands need not be replaced in their original location but must be replaced in acreage equal to total acreage destroyed within each sub-drainage basin. Edge/area relationship should be considered in isolated wetland replacement.

CATEGORY 3 - Mine Without Restoration

Category 3 wetlands are wetlands less than 5 acres in size as defined by dominant vegetation, are isolated, have insignificant hydrological function and do not substantially contribute to maintenance of fish and wildlife production in the region.

The three categories of wetlands on the Duette site are delineated in Figure 6-1. A segment of the East Fork Manatee River is a major Category 1 wetland proposed for mining. EPA recommends that this segment, as well as all other Category 1 wetlands, be preserved.

Any of the Category 2 wetlands which are proposed for mining may be mined and must be restored. The proposed reclamation plan will result in a net gain of 15% for swamp and marsh acreage on the site.

- Make efforts to preserve archaeological or historical sites through avoidance or mitigate by salvage excavation performed by a professionally competent agency any sites deemed significant by the Florida Division of Archives, History, and Records Management. If mitigation is chosen, the resulting report should be submitted to that state agency for examination and comment.

One archaeological site of significance, the Carruther's Mound, was identified on the Swift property.

The mound is in an area which is not scheduled for mining and hence will not be destroyed in that operation. It would, however, be isolated from its former environment. Therefore, EPA proposes that the site be excavated under the supervision of an individual or agency approved by the Florida Division of Archives, History and Records Management prior to mining the area surrounding the site.

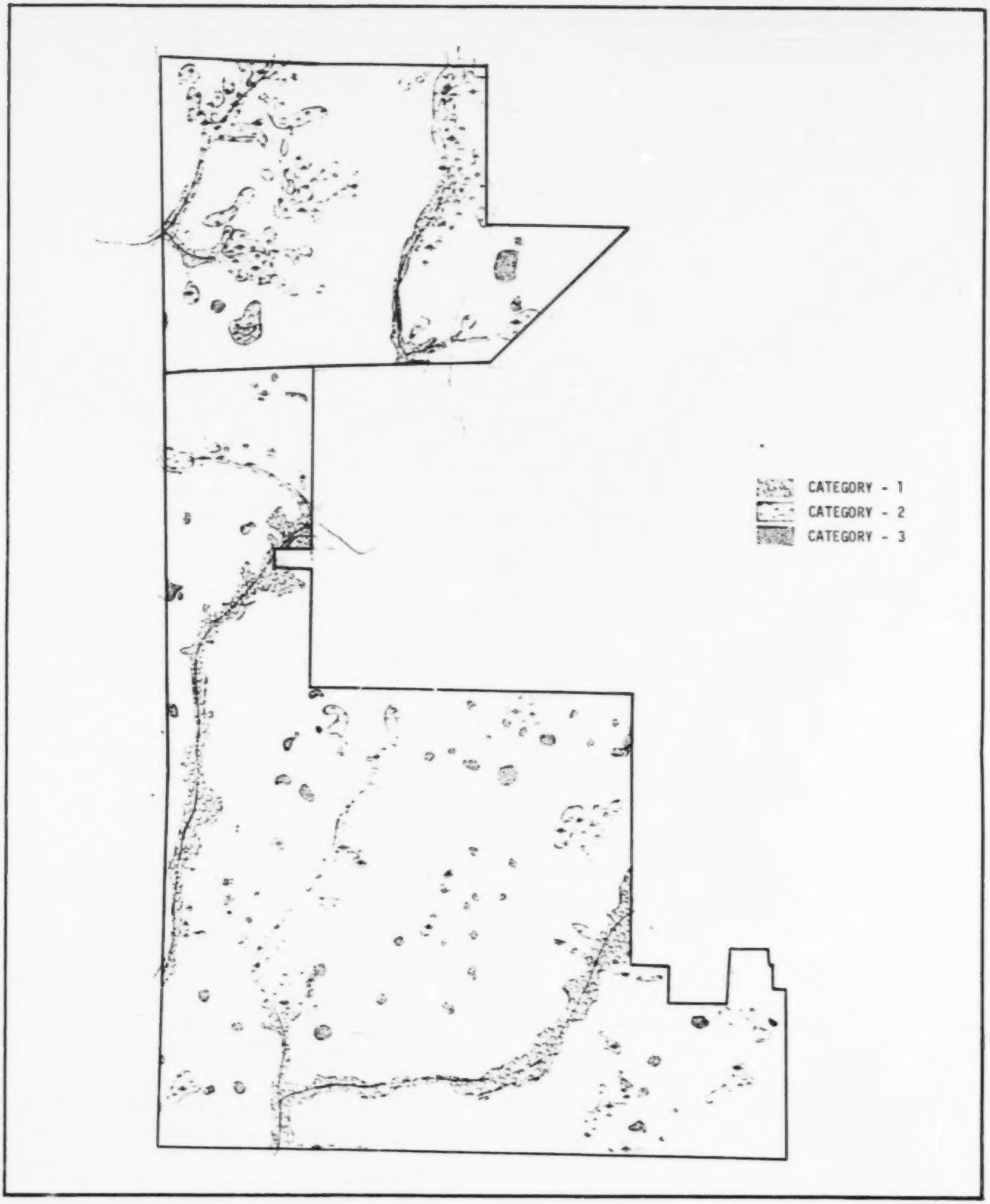

FIGURE 6-1

WETLAND CATEGORIZATION

Source: Conservation Consultants, Inc.

U.S. EPA - REGION IV
DRAFT ENVIRONMENTAL
IMPACT STATEMENT FOR
SWIFT AGRICULTURAL CHEMICALS
CORPORATION PROPOSED
DUETTE MINE
MANATEE COUNTY, FLORIDA

7.0 PROPOSED AGENCY ACTIONS

The Areawide EIS establishes a basis for initiating a site specific EIS for a new source mining opeation. This site specific EIS has examined the mining and reclamation plan by Swift and assessed the impacts of the proposed activities.

The Swift proposal deviates from the Areawide EIS recommendations in two significant areas: 1) construction of a rock drying facility and 2) mining of a segment of the East Fork Manatee River, a Category I wetland.

The proposed drying facility is dictated by the market conditions under which Swift operates, and may be justified on the basis of the amount of rock to be shipped outside of Florida for Chemical processing. An analysis of proposed air quality impact was performed in a manner consistent with objectives of Prevention of Significant Deterioration (PSD) and includes results of preconstruction monitoring activities, control equipment selection to achieve BACT, emissions estimates and mathematical modeling to insure conformance with PSD increments and National Ambient Air Quality Standards (NAAQS).

This detailed examination of short and long term areawide and cumulative effects of the proposed drying facility has demonstrated that air quality standards will not be violated, air quality will not be significantly degraded, and sulfur dioxide and particulate matter emissions will satisfy New Source Performance Standards and Best Available Control Technology. Therefore EPA proposes to approve the rock drying facilities and issue the required permits pursuant to provision of the Clean Air Act.

The segment of the East Fork Manatee River proposed for mining has been determined to be a Category I wetland. Such wetlands provide important ecological functions including erosion control protection and acting as a living filter by removing sediments and other pollutants from flood waters. In addition, these wetlands are very productive and export a portion of this biological productivity to downstream areas. The efficient functioning of such a complex community is dependent upon presence of all of its member populations. Restoration of a major complex floodplain would be slow, if possible at all. Thus, EPA recommends that the functioning system be left intact, which would assure preservation of the biological integrity of the floodplain of the East Fork of the Manatee River. Based on the above considerations, EPA believes that mining should not proceed in the East Fork Manatee River.

EPA proposes to issue an NPDES permit pursuant to the Clean Water Act of 1977. The permit will include as conditions all those recommendations contained in the Areawide EIS which pertain to mining except the recommendation concerning rock dryers as noted above.

Permit No. FL0036609

AUTHORIZATION TO DISCHARGE UNDER THE NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM

In compliance with the provisions of the Federal Water Pollution Control Act, as amended, (33 U.S.C. 1251 et. seq; the "Act"),

Estech General Chemicals Corporation
(formerly Swift Agricultural Chemicals Corporation)
1st Commercial Bank Building
410 Cortez Road, West
Bradenton, Florida 33507

is authorized to discharge from a facility located at

Duette Mine
Between East and North Forks Manatee River
About Latitude 27° 32' 09" & Longitude 82° 07' 13"
Manatee County, Florida

to receiving waters named

East and North Forks of Manatee River

in accordance with effluent limitations, monitoring requirements and other conditions set forth in Parts I, II, and III hereof.

This permit shall become effective on

This permit and the authorization to discharge shall expire at midnight,

Signed ____________________

DRAFT

Sanford W. Harvey, Jr.
Director
Enforcement Division

EPA Form 3320-4 (10-73)

DRAFT

A. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

During the period beginning on the effective date and lasting through the term of this permit, the permittee is authorized to discharge from outfall(s) serial number(s) 001, 002, and 003 process generated wastewater mine.
Such discharges shall be limited and monitored by the permittee as specified below:

Effluent Characteristic	Discharge Limitations				Monitoring Requirements	
	kg/day (lbs/day)		Other Units (Specify)			
	Daily Avg	Daily Max	Daily Avg	Daily Max	Measurement Frequency (During Discharge)	Sample Type
Flow—m^3/Day (MGD)	—	—	—	—	1/Week	Discrete*
Total Suspended Solids	--	--	30 mg/1	60 mg/1	1/Week	24 Hr. Composite
Total Fluoride (as F)	--	--	10 mg/1	10 mg/1	1/Week	24 Hr. Composite

*Any measurement or determination representative of the actual discharge.

*Any measurement or determination representative of the actual flow.

Any overflow from facilities designed, constructed, and maintained to contain or treat the volume of wastewater which would result from a 10-year, 24-hour precipitation event shall not be subject to the effluent and pH limitations listed on this page.

The pH shall not be less than 6.0 standard units nor greater than 9.0 standard units and shall be monitored 1/week during discharge with a grab sample.

There shall be no discharge of floating solids or visible foam in other than trace amounts.

Samples taken in compliance with the monitoring requirements specified above shall be taken at the following location(s): nearest accessible point after final treatment but prior to actual discharge or mixing with the receiving stream.

The effluent limits, and any additional requirements, specified in the attached state certification supersede any less stringent effluent limits listed above. During any time period in which more stringent state certification effluent limits are stayed or inoperable, the effluent limits listed above shall be in effect and fully enforceable.

2. DEFINITIONS

(a.) The term "mine dewatering" shall mean any water that is impounded or that collects in the mine and is pumped, drained, or otherwise removed from the mine through the efforts of the mine operator. However, if a mine is also used for the treatment of process generated wastewater, discharges of commingled water from the mine shall be deemed discharges of process generated wastewater.

(b.) The term "10-year, 24-hour precipitation event" shall mean the maximum 24-hour precipitation event with a probable re-occurrence internal of once in 10 year. This information is available in "Weather Bureau Technical Paper No. 40, May 1961 and may be obtained from the Environmental Data Service, Nation Oceanic and Atmospheric Administration, U.S. Department of Commerce.

(c.) The term "mine" shall mean an area of land, surface or underground, actively used for or resulting from the extraction of a mineral from natural deposits.

(d.) The term "process generated wastewater" shall mean any wastewater used in the slurry transport of mined material, air emissions control, or processing exclusive of mining. The term shall also include any other water which becomes commingled with such wastewater in a pit, pond, lagoon, mine, or other facility used for settling or treatment of such wastewater.

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B. SCHEDULE OF COMPLIANCE

1. The permittee shall achieve compliance with the effluent limitations specified for discharges in accordance with the following schedule:

   a. Permittee shall comply with the effluent limitations by the effective date of the permit.

   b. This permit shall be modified, or alternatively, revoked and reissued, to comply with any applicable effluent standard or limitation issued or approved under sections 301(b)(2) (C), (D), (E), and (F), 304(b)(2), and 307(a)(2) of the Clean Water Act, if the effluent standard or limitation so issued or approved:

      (1) Contains different conditions or is otherwise more stringent than any effluent limitation in the permit; or
      (2) Controls any pollutant not limited in the permit.

   The permit as modified or reissued under this paragraph shall also contain any other requirements of the Act then applicable.

2. No later than 14 calendar days following a date identified in the above schedule of compliance, the permittee shall submit either a report of progress or, in the case of specific actions being required by identified dates, a written notice of compliance or noncompliance. In the latter case, the notice shall include the cause of noncompliance, any remedial actions taken, and the probability of meeting the next scheduled requirement.

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C. MONITORING AND REPORTING

1. *Representative Sampling*

Samples and measurements taken as required herein shall be representative of the volume and nature of the monitored discharge.

2. *Reporting*

Monitoring results obtained during the previous 3 months shall be summarized for each month and reported on a Discharge Monitoring Report Form (EPA No. 3320-1), postmarked no later than the 28th day of the month following the completed reporting period. The first report is due on December 31, 1979 . Duplicate signed copies of these, and all other reports required herein, shall be submitted to the Regional Administrator and the State at the following addresses:

Environmental Protection Agency
Water Enforcement Branch
345 Courtland Street, N.E.
Atlanta, Georgia 30308

3. *Definitions*

a. The "daily average" discharge means the total discharge by weight during a calendar month divided by the number of days in the month that the production or commercial facility was operating. Where less than daily sampling is required by this permit, the daily average discharge shall be determined by the summation of all the measured daily discharges by weight divided by the number of days during the calendar month when the measurements were made.

b. The "daily maximum" discharge means the total discharge by weight during any calendar day.

4. *Test Procedures*

Test procedures for the analysis of pollutants shall conform to regulations published pursuant to Section 304(g) of the Act, under which such procedures may be required.

5. *Recording of Results*

For each measurement or sample taken pursuant to the requirements of this permit, the permittee shall record the following information:

a. The exact place, date, and time of sampling;

b. The dates the analyses were performed;

c. The person(s) who performed the analyses;

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A. MANAGEMENT REQUIREMENTS

1. *Change in Discharge*

All discharges authorized herein shall be consistent with the terms and conditions of this permit. The discharge of any pollutant identified in this permit more frequently than or at a level in excess of that authorized shall constitute a violation of the permit. Any anticipated facility expansions, production increases, or process modifications which will result in new, different, or increased discharges of pollutants must be reported by submission of a new NPDES application or, if such changes will not violate the effluent limitations specified in this permit, by notice to the permit issuing authority of such changes. Following such notice, the permit may be modified to specify and limit any pollutants not previously limited.

2. *Noncompliance Notification*

If, for any reason, the permittee does not comply with or will be unable to comply with any daily maximum effluent limitation specified in this permit, the permittee shall provide the Regional Administrator and the State with the following information, in writing, within five (5) days of becoming aware of such condition:

a. A description of the discharge and cause of noncompliance; and

b. The period of noncompliance, including exact dates and times; or, if not corrected, the anticipated time the noncompliance is expected to continue, and steps being taken to reduce, eliminate and prevent recurrence of the noncomplying discharge.

3. *Facilities Operation*

The permittee shall at all times maintain in good working order and operate as efficiently as possible all treatment or control facilities or systems installed or used by the permittee to achieve compliance with the terms and conditions of this permit.

4. *Adverse Impact*

The permittee shall take all reasonable steps to minimize any adverse impact to navigable waters resulting from noncompliance with any effluent limitations specified in this permit, including such accelerated or additional monitoring as necessary to determine the nature and impact of the noncomplying discharge.

5. *Bypassing*

Any diversion from or bypass of facilities necessary to maintain compliance with the terms and conditions of this permit is prohibited, except (i) where unavoidable to prevent loss of life or severe property damage, or (ii) where excessive storm drainage or runoff would damage any facilities necessary for compliance with the effluent limitations and prohibitions of this permit. The permittee shall promptly notify the Regional Administrator and the State in writing of each such diversion or bypass.

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inspection at the offices of the State water pollution control agency and the Regional Administrator. As required by the Act, effluent data shall not be considered confidential. Knowingly making any false statement on any such report may result in the imposition of criminal penalties as provided for in Section 309 of the Act.

4. *Permit Modification*

After notice and opportunity for a hearing, this permit may be modified, suspended, or revoked in whole or in part during its term for cause including, but not limited to, the following:

a. Violation of any terms or conditions of this permit;

b. Obtaining this permit by misrepresentation or failure to disclose fully all relevant facts; or

c. A change in any condition that requires either a temporary or permanent reduction or elimination of the authorized discharge.

5. *Toxic Pollutants*

Notwithstanding Part II, B-4 above, if a toxic effluent standard or prohibition (including any schedule of compliance specified in such effluent standard or prohibition) is established under Section 307(a) of the Act for a toxic pollutant which is present in the discharge and such standard or prohibition is more stringent than any limitation for such pollutant in this permit, this permit shall be revised or modified in accordance with the toxic effluent standard or prohibition and the permittee so notified.

6. *Civil and Criminal Liability*

Except as provided in permit conditions on "Bypassing" (Part II, A-5) and "Power Failures" (Part II, A-7), nothing in this permit shall be construed to relieve the permittee from civil or criminal penalties for noncompliance.

7. *Oil and Hazardous Substance Liability*

Nothing in this permit shall be construed to preclude the institution of any legal action or relieve the permittee from any responsibilities, liabilities, or penalties to which the permittee is or may be subject under Section 311 of the Act.

8. *State Laws*

Nothing in this permit shall be construed to preclude the institution of any legal action or relieve the permittee from any responsibilities, liabilities, or penalties established pursuant to any applicable State law or regulation under authority preserved by Section 510 of the Act.

9. *Property Rights*

The issuance of this permit does not convey any property rights in either real or personal property, or any exclusive privileges, nor does it authorize any injury to private property or any invasion of personal rights, nor any infringement of Federal, State or local laws or regulations.

10. *Severability*

The provisions of this permit are severable, and if any provision of this permit, or the application of any provision of this permit to any circumstance, is held invalid, the application of such provision to other circumstances, and the remainder of this permit, shall not be affected thereby.

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PART III

Definitions

1. The "daily average" concentration means the arithmetic average (weighted by flow value) of all the daily determinations of concentration made during a calendar month. Daily determinations of concentration made using a composite sample shall be the concentration of the composite sample. When grab samples are used, the daily determination of concentration shall be the arithmetic average (weighted by flow value) of all the sample collected during that calendar day.

2. The "daily maximum" concentration means the daily determination of concentration for any calendar day.

3. "Weighted by flow value" means the summation of each sample concentration times its respective flow in convenient units divided by the summation of the respective flows.

4. Composite Sample: A "24-hr. composite sample" is any of the following:

   a. Not less than six influent or effluent portions collected at regular intervals over a period of 24 hours and composited in proportion to flow.

   b. Not less than six equal volume influent or effluent portions collected over a period of 24 hours and composited in proportion to the flow.

   c. An influent or effluent portion collected continuously over a period of 24 hours at a rate proportional to the flow.

5. For the purpose of this permit, a calendar day is defined as any consecutive 24-hour period.

COORDINATION LIST

The following Federal, State, and local agencies and interested groups have been requested to comment on this impact statement:

Federal Agencies

Bureau of Outdoor Recreation
Bureau of Mines
Coast Guard
Corps of Engineers
Council on Environmental Quality
Department of Agriculture
Department of Commerce
Department of Health, Education and Welfare
Department of the Interior
Department of Transportation
Energy Research and Development Agency
Federal Highway Administration
Fish & Wildlife Service
Food and Drug Administration
Forest Service
Geological Survey
National Park Service
Nuclear Regulatory Commission
Soil Conservation Service
Economic Development Administration

Members of Congress

Honorable Lawton Chiles
United States Senate

Honorable Sam Gibbons
U. S. House of Representatives

Honorable Skip Bafalis
U. S. House of Representatives

Honorable Richard Stone
United States Senate

Honorable Andy P. Ireland
U. S House of Representatives

State

Honorable D. Robert Graham
Governor
Patrick K. Neal
State Senator
Ralph H. Haben, Jr.
State Representative
Lawrence F. Shackleford
State Representative
Thomas E. Danson, Jr.
State Representative
Ted Ewing
State Representative
Coastal Coordinating Council
Department of Natural Resources
Department of Agriculture and Consumer Services
Department of Administration
Department of State
Environmental Regulation Committee
Geological Survey
Game and Freshwater Fish Commission
Department of Commerce
Department of Health and Rehabilitative Services
Bureau of Intergovernmental Relations
Department of Environmental Regulation

Interest Groups

The Fertilizer Institute
Florida Phosphate Council
Florida Audubon Society
Florida Sierra Club
Tampa Audubon Society
Florida Defenders of the Environment
Izaac Walton League of America

Manasota 88
League of Women Voters
Conservation Council of Manatee County
Florida Division
Florida Wildlife Federation

Local and Regional

Polk County Commission
Hillsborough County Commission
Manatee County Commission
DeSoto County Commission
Hardee County Commission
Charlotte County Commission
Sarasota County Commission
Tampa Bay Regional Planning Council
Sarasota County Health Dept.
Hillsborough County Department of Environmental Protection
Manatee County Department of Pollution Control
Sarasota County Environmental Control Department
Southwest Florida Water Management District

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